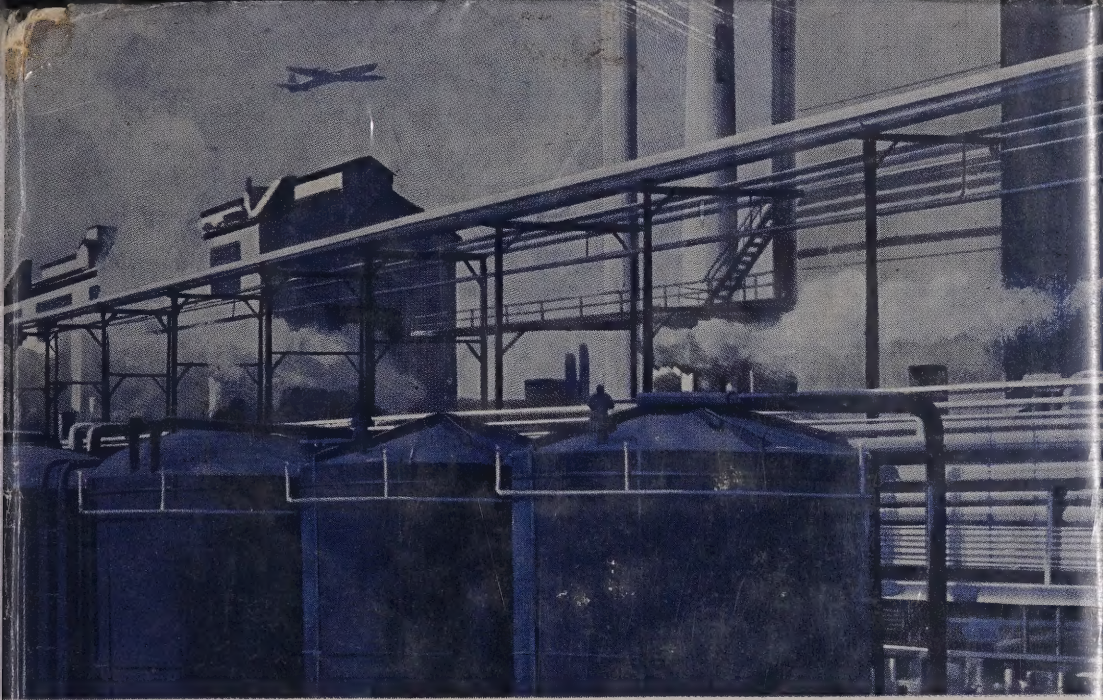

FAMOUS INDUSTRIALISTS

SIGMUND A. LAVINE

Author of "Steinmetz, Maker of Lighting," etc.

$3.25

FAMOUS INDUSTRIALISTS

By Sigmund A. Lavine

AUTHOR OF
"KETTERING: MASTER INVENTOR," ETC.

ILLUSTRATED BY GERALD MC CANN

FAMOUS INDUSTRIALISTS offers young people a firsthand acquaintance with some outstanding men who have created, improved or directed various processes, products and services that have contributed greatly to our well-being and happiness. Among the businessmen included in this volume who have played leading roles in the drama of America's technical progress are David Sarnoff (Radio), Harvey Firestone (Rubber), George Eastman (Photography), Andrew Carnegie (Steel), Walt Disney (Motion Pictures), Cyrus McCormick (Farm Equipment), Henry Ford (Automobile), Thomas J. Watson, Sr. (International Business Machines), and George Westinghouse (Air Brake, etc.).

While Sigmund Lavine has been careful to set down all those details which are essential for accuracy and complete understanding, he has remembered the preferences of the many classes he has taught and has added human interest to concise facts.

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Famous Industrialists

by *Sigmund A. Lavine*

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FAMOUS BIOGRAPHIES
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FOR YOUNG PEOPLE

Dodd, Mead & Company
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For Murray:
industrialist and friend

Acknowledgments

Many men are responsible for America's becoming the world's leading industrial nation. They include pioneers working in crude home workshops, founders of factories along the Fall Line, and builders of atomic-powered plants. Of them all, however, only a comparative few have been daring men of vision who either changed accepted manufacturing techniques or created new industries. Some of these individuals were native born, others immigrants, but all share in common an inventive genius, a talent for organization, great business ability, and a drive that compelled them to attempt what others thought impossible.

In order to relate the achievements of these men, I have asked for, and received, assistance from many sources. While I am deeply grateful to all the organizations and individuals who have helped me, special thanks are due to: Florence Anderson, secretary of the Carnegie Corporation of New York; Harry Edmunds, manager research and information department, Ford Motor Company; Bernard Frazier, Eastern public relations manager, The Firestone Tire and Rubber Company; Edward Gould, assistant manager public relations, Armour and Company; Pauline Hansen, director public relations, Eastman Kodak Company; Betty Hessinger, public relations, Westinghouse Electric Corporation; John Joseph, director public relations, Hilton Hotels Corporation; William Rodgers of Banner and Greif; John Vance, director public relations, International Harvester Company; Francis Waters, Jr., director public relations, General Foods Corporation; and W. Winger, department of information, International Business Machines Corporation.

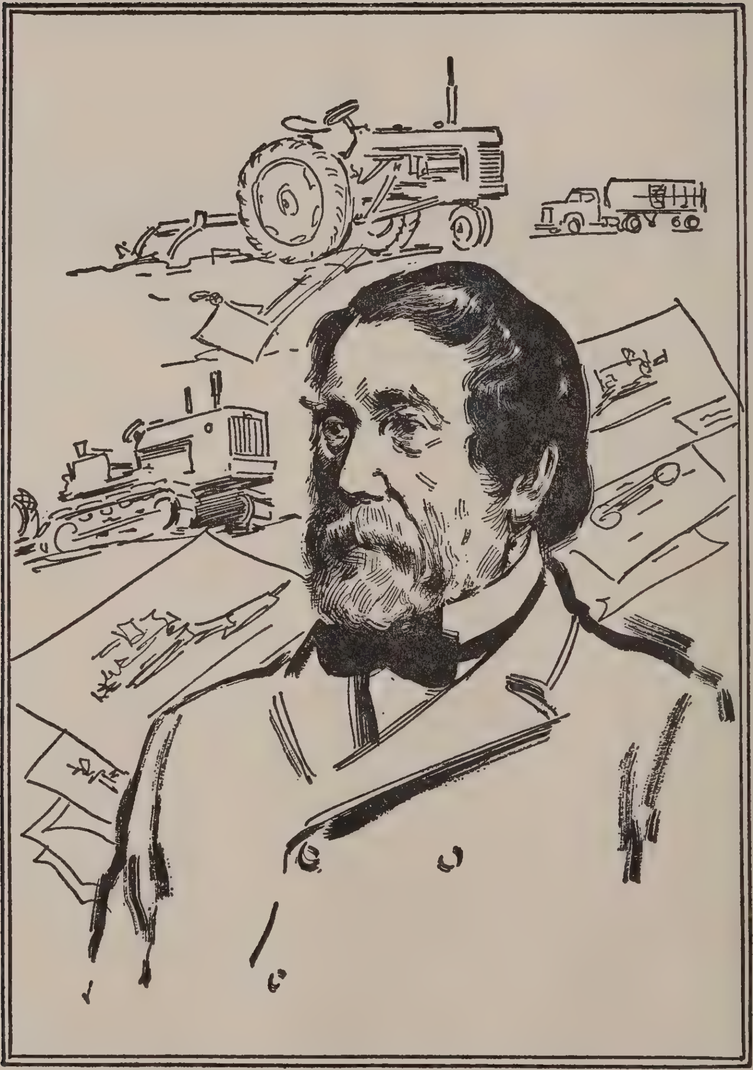
Tahigwa Sigmund A. Lavine
Sanbornton, N.H.

Contents

Cyrus Hall McCormick (1809–1884) 15
Philip D. Armour (1832–1901) 25
George Eastman (1854–1932) 35
Andrew Carnegie (1835–1919) 47
George Westinghouse (1846–1914) 57
Henry Ford (1863–1947) 69
Harvey S. Firestone (1868–1938) 83
Thomas J. Watson, Sr. (1874–1956) 93
Alfred Carl Fuller (1885–) 103
Clarence Birdseye (1886–1956) 113
Conrad N. Hilton (1887–) 123
David Sarnoff (1891–) 135
Walt Disney (1901–) 145
Index 155

Cyrus Hall McCormick

1809 - 1884



Cyrus Hall McCormick

1809-1884

On a hot July day, a crowd of plantation owners, farmers and field hands gathered on the edge of a small field near Steele's Tavern. Few of them, except the family of 22-year-old Cyrus McCormick, expected his mechanical grain-cutting machine to work, but watching the demonstration provided an excuse for a holiday—and amusement was scarce in Virginia in 1831.

There was good reason for expecting Cyrus' machine to fail. Ever since the Carthaginians had tried to perfect a power implement for reaping grain in 150 B.C., all attempts to substitute a mechanical tool for hand labor at harvest time had proved unsuccessful. Therefore, in the early part of the nineteenth century, farmers still used three simple tools. These were the sickle, a narrow, curved blade with a serrated cutting edge employed by men in prehistoric times; the scythe, invented by the Egyptians, which had a wide blade fastened to a bent wooden handle; and the cradle, devised by the ancient Romans. Introduced into this country at the time of the American Revolution, the cradle was the most highly developed form of the scythe. It consisted of a framework of wooden fingers attached to the handle of the scythe, parallel to the blade. The object of the fingers was to make the cut grain fall properly for binding. Using a cradle, a good workman could cut two acres of grain in a day in such a way that it fell with the heads in one direction. This made binding easier.

Just as the onlookers were becoming restless, young McCormick nodded to the youngster astride the horse attached to the reaper. The barefoot boy dug his heels into his mount and the machine moved slowly across the field. The crowd watched silently as the grain fell on the platform behind the cutting knife and as Jo Anderson, the faithful slave who had helped construct the machine, raked it off, forming long rows. . . . Suddenly, a loud shout went up—McCormick's reaper worked!

Cyrus' father cheered louder than anyone else. A wealthy farmer who operated saw and grist mills, a smelter and a blacksmith shop, Robert McCormick had spent fifteen years trying to build a mechanical reaper, but had given up two months previously when his last invention, like all the others, proved a failure. Now, in less than six weeks, Cyrus had developed a workable reaper. While Mr. McCormick was proud of his son, he was not too surprised at his success, for the boy had always shown mechanical ingenuity. At fifteen, too weak to swing a heavy cradle, he had fashioned a lighter one; at eighteen he had made a set of surveying instruments; while only a few weeks earlier he had received a patent on a hillside plow.

When young McCormick worked in the log blacksmith shop on the family farm, he had no idea that anyone else except his father had ever tried to make a reaper. Dissatisfied with his first model, he made another. When it was finished, it contained seven basic elements—all of which are still used in grain-cutting machinery. While Cyrus originated all of them independently, he was actually duplicating the discoveries of others, except in the case of the master wheel. This wheel carries most of the weight of the reaper and, through ground traction, furnishes the power to operate the reel which holds the grain against the knife and lays the cut stalks on the platform. Because Cyrus made no attempt to patent his invention until 1834, after three years of constant experimentation, he had no knowledge of the prior discovery of some of the features of his machine. However, since McCormick was the first to successfully combine all of these devices with his wheel, he is considered the inventor of the reaper.

Cyrus McCormick began selling reapers in 1840, but they proved unsatisfactory and he spent the following year perfecting the cutting knife. Four years later he built fifty of the machines in his father's shop, and sold them for $1000 each. He shipped several to farms as far away as Wisconsin. That fall, McCormick, curious to know why he was receiving orders from western states, visited his customers. Writing home, he said, "Reapers are luxuries in Virginia, but necessities on the great plains of the West."

He decided to move nearer the prairies in order to be closer to this potential market and to cut transportation costs. Meanwhile, he gave licenses to several firms to manufacture his machines on a royalty basis, since it was impossible to meet the demand with the limited facilities of his blacksmith shop. In 1847, he established a factory in Chicago with two partners, but within a short time he bought them out for $65,000. His next step was to refuse to renew the licenses when they expired. Customers were complaining that reapers made under this arrangement were poorly constructed and contained inferior materials—and McCormick insisted upon quality.

In order to make sure that his reapers would be satisfactory, Cyrus set up a rigid inspection system and standardized parts so that they could be replaced quickly and easily if necessary. He built a machine so that it would give years of service.

He became the first manufacturer in America to guarantee absolute satisfaction or return of the purchase price. He kept this promise when the gears of the 1853 reapers failed. He replaced every one of them free of charge—an almost unheard of procedure at that time.

No modern industrialist has greater faith in the power of advertising and the value of publicity than did McCormick. "To sell, I must advertise," he maintained. Farm raised, he knew the type of advertisements that would appeal to farmers, who were not inclined to welcome new things and were cautious about spending money. McCormick wrote all the advertisements himself. They usually contained an illustration showing a reaper being pulled at a trot by a pair of horses, while a man, dressed in a business suit, was raking the platform—conveying the impression that the reaper was very light and one didn't have to wear work clothes to operate it. Beneath the picture was a long mechanical description which was easy to follow as the parts of the illustrated reaper were numbered. McCormick knew that farmers would want full information about his product, so he used small type—getting more words in a column and saving money!

Often McCormick included testimonials from prominent figures in his advertisements—which is still a wide-spread advertising practice. Another clever scheme was to appoint editors of country newspapers as his sales representatives. McCormick didn't expect them to sell reapers, for there was a large sales force in the field, but he wisely figured that this would give him frequent mention of the machine in their columns free of charge.

In addition to advertising in newspapers and farm journals, McCormick also became one of the first direct-mail advertisers. His local agents sent prospective clients personal letters and detailed descriptions of the reaper and then followed this up with a personal call. Every rural community was familiar with the McCormick reaper—handbills were posted on all available fences and given to local merchants to use as wrapping paper.

McCormick also entered his reaper in field tests all over the world, and he made sure the public heard of the contests they won. His machines were awarded the highest honors at international expositions, and McCormick shrewdly illustrated his catalogue with pictures of the medals earned. Whenever he thought the public might be forgetting the McCormick reaper, Cyrus would send letters to his editor friends, challenging all other power grain cutters. "I warrant my reapers superior to all others," he once wrote. "I have a reputation to maintain. Let a farmer take both and keep the one he likes best."

There was little doubt as to which reaper most of the farmers preferred, and McCormick made it easier for them to buy his product—thus becoming a pioneer in easy credit terms. In the 1850's, a reaper cost $125. Customers paid $35 down, plus the freight from Chicago, and the balance on December 1, with 6 per cent interest from July 1. While the contract stated that non-payment would result in a lawsuit, McCormick never took a farmer into court—good will being more important to him than cash.

Constantly improving his "Patent Virginia Reaper," McCormick made many changes in his original model. Eventually he produced a machine equipped with a rake arm that swept the grain off the platform and to the side of the reaper, thus eliminating the time and work of one man. Freed from the farm, thousands of laborers went to the cities where they were absorbed by America's growing industries. Nothing proved the value of the reaper more than the War Between the States.

Secretary of War Stanton said, "The reaper is to the North what slavery is to the South. By taking the place of regiments of young men in western harvest fields, it released them to do battle for the Union at the front and at the same time kept up a supply of bread for the nation and the nation's armies. Thus, without McCormick's invention I feel the North could not win and the Union would have been dismembered."

Meanwhile, other inventors had devised several improvements in grain-cutting machinery. Those that McCormick thought had value, he used on his reapers, either buying the patents or paying royalties for them. For a while he made reapers that employed wire for binding, then shifted to one that used twine. These machines made it possible for farmers to harvest more than they could plant by hand, which led to the invention of other power farming tools. As a result, it was no longer necessary for nine-tenths of the world's population to engage in agriculture in order to feed themselves and the other tenth.

When McCormick wasn't improving his reaper or suing some manufacturer for infringing on his patents—in one case that he lost, Lincoln was his lawyer—he took an active part in religious and educational activities. Not only did he give large sums of money to churches and colleges, but he also published two religious periodicals. Feeling that war between the North and South was not necessary, he bought the Chicago *Sun*, hoping to influence the Democrats to prevent the conflict.

After the war, many former soldiers decided to take advantage of the Homestead Act of 1862 and secure free land in the West from the government. Thanks to McCormick's invention, the frontier was pushed forward thirty miles a year, as buffalo grass gave way to fields of wheat. McCormick reapers were being used overseas, too, and in 1879 their inventor was elected a member of the French Academy of Sciences "as having done more for agriculture than any other living man."

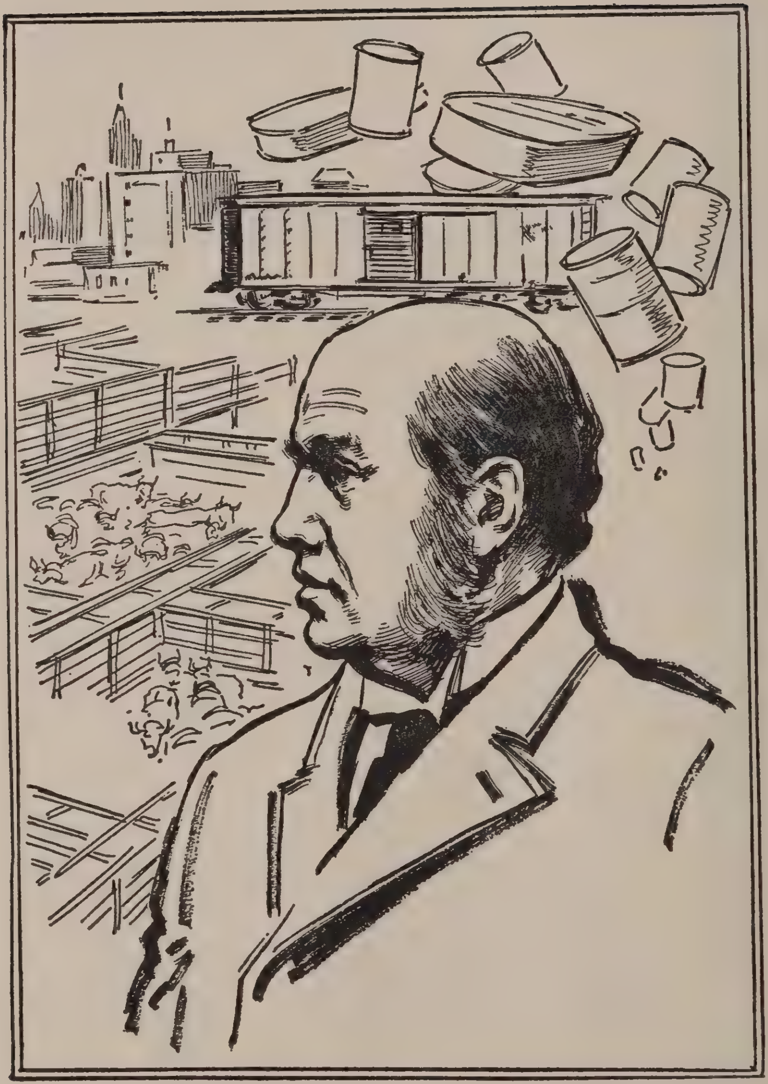
Cyrus' wife, Nancy, was a most unusual woman for her time. Unlike most married women of that day, she took a keen interest in her husband's business, despite caring for their seven children. McCormick frequently asked her advice in dealing with competitors and usually followed it. Busy as he was, Cyrus always had time for the children and never returned from a European trip without bringing each of them a novel gift.

McCormick was no absent-minded inventor, but a man of action. Along with his creative ability, he was extremely practical and very resourceful. Stubborn, he would choose a course of action and go ahead, regardless of the consequences, willingly fighting battles in court or newspapers to prove that he was right.

Until he died on May 13, 1884, Cyrus Hall McCormick was always trying to lessen the work load of the farmer. Although some of his machines have long been discarded, others made possible the mammoth thresher-harvesters of today. Therefore, men will honor his name "so long as the ripening grain shall wave over the boundless plains of the West, or the song of the reaper shall be heard in the harvest fields."

Philip D. Armour

1832-1901



Philip D. Armour

1832-1901

Mrs. Armour was sure that everyone in Stockbridge was talking about her son. A former schoolteacher, she had tried to make her six boys appreciate the value of an education—and now Philip had been expelled from school! Her husband, a stern Scotchman, was far more concerned with his son's future than with back-yard gossip. "Young man," he thundered, "if you can't go to school, you must go to work."

Work was nothing new to Philip. There were always chores to do on the family farm in upstate New York, so he didn't find his duties too difficult after being "bound out" to a neighboring farmer. Then, when Philip was seventeen, the thrilling news that gold had been discovered in California reached Stockbridge. Young Armour became tremendously excited as he read the dispatches from Sutter's Fort. Years later he recalled, "I was taken with the fever and brooded over the difference between tossing hay in the hot sun and digging up gold by the handfuls." Finally, he threw down his pitchfork, told his master he wanted to go West, and was released from his apprenticeship.

Philip didn't have enough money to pay for passage on a vessel and sail around Cape Horn to California, but he could afford the railroad fare as far as Independence, Missouri, where many wagon trains began the long, dangerous journey across the plains. Hired as a teamster, he made the long trek to the Sacramento Valley trudging beside a yoke of lumbering oxen.

Although Armour struck pay dirt on his claim, he soon came to the conclusion that building a ditch to carry water to his fellow miners would be more profitable than digging for gold. He was right—in a short time he had $6000 in his money belt and he returned to Stockbridge. After visiting his parents, Philip went to Milwaukee and there became a successful soap manufacturer, but his factory burned down. His next venture took him to St. Louis, the center of the fur trade, where he dealt in hides for two years. Then, in 1859, Armour went back to Milwaukee and, with a partner, sold salted and pickled meats to emigrants going West. He also bought a grain elevator and shares in an established pork-packing concern.

As early as 1863, Armour was convinced that the North would win the War Between the States. Other packers could not see beyond the great demand and high prices caused by the conflict, but "P.D.," as he was known to his friends, was sure that there would be a glut of pork on the market with the coming of peace. Therefore, he constantly studied the news from the battlefields and kept in close touch with the Eastern markets by telegraph. Shortly before Lee surrendered, he felt secure in selling pork "short"—the technical term for promising to deliver goods at a future date at a price below the current market. As a result, he made a million dollars.

By 1867, Armour and Company had several branch packing plants throughout the West and had expanded its activities to include slaughtering of long-horned steers hazed along the Overland Trail from Texas to Kansas City. Most of these branches were managed by Armour's brothers who carefully watched out for his interests. However, no one paid more attention to details than P.D. himself. Gifted with the ability to see an opportunity and take advantage of it, he bought and sold pork products so rapidly in 1875 that he made $9,000,000 in two deals!

Although by now he had far more wealth than he had ever hoped to find in the California gold fields, Armour still gave his undivided attention to business. He would get up at five in the morning, eat breakfast at six, pick up the reins on a team of fast trotters and drive to the office and begin reading telegrams on the dot of seven. If one of the office help arrived a fraction of a second after he did, Armour would greet him with a sarcastic, "Good afternoon." No one ever offered an excuse for being late—for P.D. had a violent temper and, although he boasted of his ability to control it, he rarely could. Yet he was extremely gentle with women and children.

Quick to flare into anger, Armour was as prompt with praise. Whenever an employee did a difficult task in a manner that met with P.D.'s approval, he would say, "Get a suit of clothes," and send the man to his personal tailor and himself pay the bill. Being an executive for Armour and Company was no easy job—it was understood that heads of departments were to be at their desks at seven in the morning, and they could not leave until there was nothing to do. Incidentally, Armour paid his assistants once a year, but allowed them to draw upon their salaries.

Armour had married Malvina Ogden in 1862. Their two sons joined their father's firm as very young men—P.D. never thought they would even think of doing anything else! A stern parent, Armour demanded more from them than from anyone else, but in a mellow mood would sometimes admit to Malvina that they were showing promise.

Armour was the busiest man in the firm. He was determined to build a business that would take the place of the farm smokehouse and the slaughtering done by local butchers. To do this meant developing a means of processing meat by a continuous system, avoiding waste and spoilage, and transporting the finished products to markets all over the world. P.D.'s first step was to devise a hook and moveable chain arrangement by which a carcass could be handled by a group of butchers, each of whom was responsible for a particular cut. This was the first assembly line in industrial history. Although eventually improved upon by others, this basic system is standardized manufacturing procedure in America and it is one of the main reasons why this country has such a high rate of production.

Once his belt line was moving smoothly, Armour turned his attention to the problem of waste. During the 1880's, many parts of the cattle, sheep and swine were thrown away. When the animals reached the stockyards they were roughly dressed (the technical name for butchering), then all the inedible parts expect the hide were discarded. P.D. was convinced that a system could be developed which would utilize every part of a meat animal. "This waste," he maintained, "is criminal! There must be something that can be made out of this material. Moreover, dumping it in the river is a menace to health. I don't know what can be done about it, but I'm going to find out."

Armour was always anxious to "find out." He explained his avid curiosity in an interview he gave in 1898 to Theodore Dreiser, who later left newspaper work to become one of America's great novelists. "I believe," P.D. said, "in finding out the truth about all things—the very latest truth or discovery—and applying it." Armour wanted the truth about the possibility of using the inedible parts of livestock, for he shrewdly saw that, if the refuse had any value, he could then sell his products cheaper than his competitors. Although P.D. could fashion tools to make meat handling easier and had a talent for running his plants in an economical manner, he did not have the technical knowledge to do the necessary research to discover possible uses of inedible animal products. Therefore, he hired a chemist and bluntly ordered him to find some way of "using every part of the pig except the squeal!"

Eventually, a long series of valuable by-products made from formerly discarded materials was developed in the firm's laboratory. By being the first meat packer to employ scientific research, Armour was able to expand his activities to include the manufacture of toilet soaps, violin strings, medicines, glue, fertilizer, glycerine and many other items. Other industries also benefited: steelmakers learned that bone scraps could be used to caseharden steel, textile mills were told about the value of albumin in fixing colors when printing calico, hatters about the wearing quality of felt made from cattle hair, powder mills about certain fats that could be used in the manufacturing of explosives. Even the handicraftsmen of Japan were indebted to Armour research—all white hoofs were shipped to that country to be made into ornaments of various kinds. But Oriental artisans were not as grateful to P.D. as were the women of America. Thanks to his desire to eliminate waste, any lady of his day could wear her hair in the popular pompadour style—all she had to do was use a "switch" made from the tails of cattle and horses!

Armour was justly proud of the fact that it was possible for his firm to manufacture by-products. For although meat packing was a well-established industry before his time—William Pynchon had set up a slaughterhouse in Springfield, Massachusetts, in colonial days to supply the West Indies with meat—P.D. was the first to see that by-products would reduce the cost of meat, increase sales and, as a result, give stockmen, packers and stores greater profits.

Newspapermen assigned to interview Armour had a difficult task. He told one reporter, "Young man, I never give interviews, but I'll give you a ham." However, he admitted to one newsman that he believed in "adopting every attainable improvement, mechanical or otherwise, in methods and appliances for handling every pound of flesh." Therefore, he became intensely interested in finding some means of transporting dressed meats to distant markets, although as early as 1869 he had made such shipments to the East from Kansas City during cold weather. When the refrigerator car was invented in 1880, Armour tried to induce railroads to build them. When they showed no interest, he bought a fleet of his own and not only carried meat in them, but fresh fruit from California as well. By 1887, he had enough cars to set up mobile branch offices in small towns.

However, led by local slaughters, the public refused to buy any meat from these "peddler cars," believing it must be inedible after being shipped so far. P.D. met the boycott by opening butcher shops of his own, but this move almost ended in disaster—he used natural ice, which melted and caused spoilage. By quickly shifting to artificial ice, Armour was able to deliver his products in good condition. Eventually, all opposition to the use of refrigerator cars vanished when government inspectors, working under the Federal Meat Inspection Act, proved that dressed meat, properly chilled while being transported, was often superior to that prepared locally. This paved the way for Armour sales offices throughout America, and opened up the European market. Now, instead of shipping cattle overseas to be butchered, dressed meat could be placed aboard a refrigerated vessel—a much more economical procedure.

Armour became one of the first packers to place meat in cans. He opened an office in New York City just to handle this product in 1884. It sold extremely well, as the widespread use by soldiers of condensed milk, preserved in cans during the War Between the States, had paved the way for its acceptance by the public.

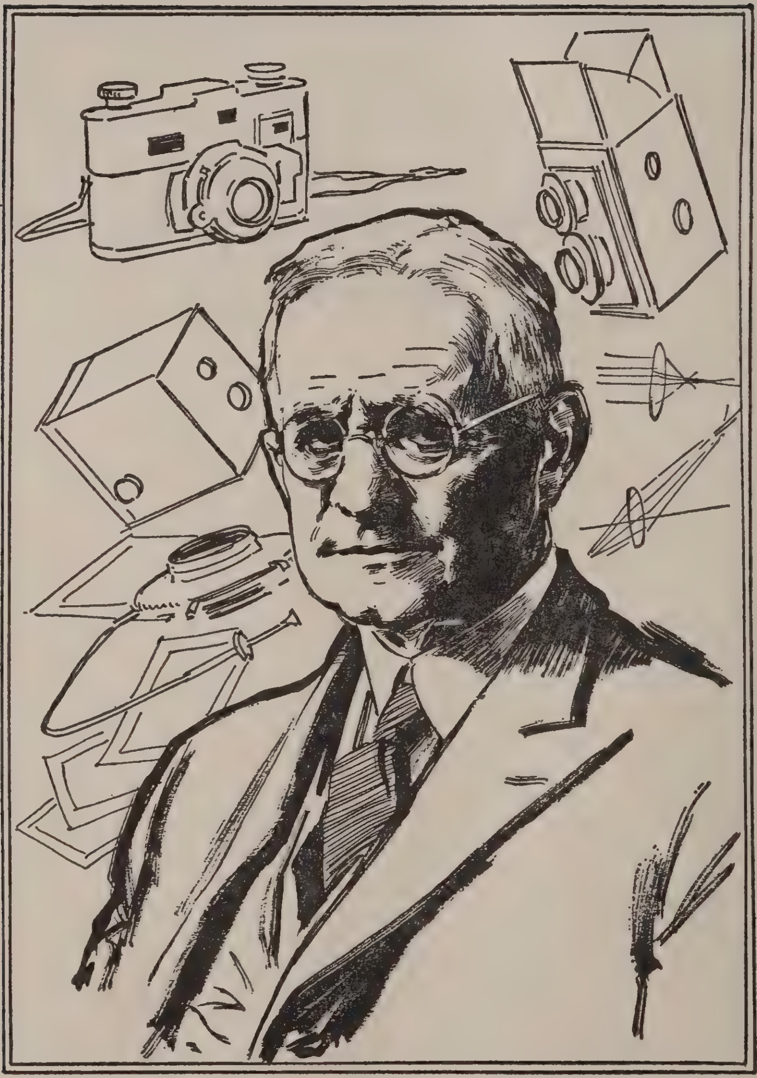
While the Panic of 1893 caused many industries to suspend operations, Armour and Company remained solvent, for P.D., who kept in touch with trade centers the world over by direct cable and telegraph lines, had foreseen the slump. Quietly borrowing $8,000,000 in gold, he was able to take advantage of his competitors during the financial flurry. Yet he felt sorry for the laboring men who had lost their savings when banks failed, and he advanced many of them enough money to meet their expenses. He could well afford this gesture, as well as the gifts he made to charitable and educational institutions. In addition to the fortune he made in meat packing, Armour's daring speculations in grain brought him many millions.

Filled with boundless energy, P.D. always "walked like a man intent on getting somewhere." A liberal, convinced that mankind could be improved, and wanting to make this possible, he gave millions away while seeking means of saving pennies in his plant. Generous, he spent little on himself, his only conceit being his frequent references to how many famous men and women in history had been sandy haired—just as he was.

However, in 1899, Armour was forced by ill health to let his sons, whom he had driven harder than any other employees, manage his interests. In hopes of regaining his strength, he went to resorts in Germany and California, accompanied by his doctor, but there was little improvement. For the next two years, P.D. contented himself with giving his sons advice and supervising their activities. Then, while playing with his grandchildren on the lawn of his home, he caught a cold. The robust farm boy who had walked to the gold fields could have shaken it off easily, but it put Philip D. Armour, the man who had revolutionized the meat-packing industry, to bed. He died on January 6, 1901.

George Eastman

1854-1932



George Eastman

1854-1932

George Eastman's father died when his son was only seven, leaving his wife and three children almost penniless. Although Mrs. Eastman opened a boardinghouse in Rochester, New York, to support the family, she still had to struggle to keep the children in school. The boy realized this and, when he was fourteen, he insisted upon going to work.

He got a job as a messenger boy in an insurance office for $3.00 a week. In addition to running errands, George lit the stove, swept the floor and did other chores. When the office closed at five, he walked a mile to the boardinghouse and spent several hours helping his mother. After following this routine for a year, Eastman went to work for another insurance firm as an office boy. His salary was $5.00 a week—and he earned every cent of it! Besides doing the work expected of him, he assumed many other tasks on his own initiative.

Always looking for some means of adding to his income, George made bookshelf brackets in his spare time and sold them from door to door. Even as a schoolboy he had been an excellent salesman. When one of his classmates admired a puzzle Eastman had fashioned out of knitting needles, he replied, "If you like it so much, why don't you buy it? The price is ten cents." When the sale was made, George recorded it in a notebook—all his life he was to keep accounts of income and expenditures. Thrifty by nature, Eastman saved money when making only $3.00 a week. By the time he was nineteen, he held a five-hundred-dollar mortgage and owned real estate. In later years, after accumulating a huge fortune, he attributed his success to the fact that he never went into debt, but always managed to save a little capital.

Hoping to secure a better-paying position, Eastman studied accounting on his evenings at home. When he was twenty-two, he thought he was going to become wealthy overnight—he invented a furnace grate, only to find that a similar product was already on the market! Disappointed, he returned to his books and in 1874 knew enough accounting to join the clerical staff of the Rochester Savings Bank where he was paid $800 a year.

Now, for the first time, Eastman could afford some pleasures. He joined a gymnasium, took German and French lessons and frequently went riding with a girl in a hired horse and buggy. When he really wanted to impress a young lady, he paid ten cents for a ticket to visit the observation roof on the top of the Powers Block. It was the greatest thrill in town—not only could you see all of Rochester from the roof, but a sight-seer rode in an elevator to the top story, seven floors above the ground, before walking up a narrow flight of stairs.

Meanwhile, George Eastman had been saving money for a trip to the island of Santo Domingo. It was to be his first vacation, and he excitedly discussed his plans with his fellow employees at the bank. After listening to him describe what he was going to see and do, one of them said enviously, "How I wish I were going with you! However, I guess I'll have to be satisfied with looking at the pictures you take when you come back."

Eastman hadn't even thought of bringing a camera with him, but it seemed an excellent idea. So the next day he invested $94.36 in a complete photographic outfit. It consisted of a big stereoscopic camera, tripod, glass jars, dishes, funnels, scales, chemicals and a darkroom tent—for taking pictures in 1877 was a complicated process. Instead of film, photographers used glass plates which they coated with collodion, then dipped them in a solution of nitrate of silver. The latter combined with the halide salt suspended in the collodion to form light-sensitive silver salt which retains photographic images. The plates had to be exposed when wet and developed immediately —the reason for the name of the process, wet plate.

After paying $5.00 for lessons, Eastman slowly mastered the technique of using a camera. Lugging over seventy pounds of equipment to the outskirts of Rochester, he'd erect his darkroom tent, make exposures and develop them. Recalling these jaunts, he later said, "One did not 'take' a camera; one accompanied the outfit of which the camera was only a part. I learned that it took not only a strong but also a dauntless man to be an outdoor photographer. . . . It seemed that one ought to be able to carry less than a packhorse load."

Despite the weight of his equipment, George became intrigued with photography. Forced to cancel the trip to Santo Domingo, he spent his vacation reading publications dealing with his hobby. By the time he went back to work, he knew all about the accomplishments of early photographers and how long it had taken to develop a material that would produce pictures in which lights and shadows appeared as seen by the human eye. However, the most exciting item Eastman read was a report on a new English process using a dry plate, consisting of a sheet of glass coated with silver salts suspended in gelatin. Not only did these plates retain their sensitivity when dry, but one could take a picture with them in 1/25 of a second. This meant that, instead of supporting a camera on a tripod while making a three- to four-second exposure, it could be held in the hand. Moreover, dry plates did not have to be developed immediately.

Eastman became one of the first persons in the United States to make gelatin dry plates, importing the materials from England and mixing the emulsion in pots on the top of his mother's stove. However, he soon began to develop his own formula. After working at the bank, George would turn the kitchen into a laboratory and experiment with chemicals until overcome by exhaustion. Often he was so tired that he fell asleep on the floor, while frequently he would crawl into bed on Saturday night and remain there until Monday morning.

Eventually, George concocted an excellent emulsion. At first he made only enough for his own use, but soon began the manufacture of dry plates for other photographers. Night after night he poured the medium over glass and spread it with a rod. This was a tedious process and George sought some simpler way. In 1879 he invented a coating machine—a roller was suspended in the liquid and large sheets of glass were drawn across it, coated, then cut to size. This was the first use of mass production in the making of photographic materials. Eastman made a hasty trip to England to patent his device, and on his return registered it in this country.

In the spring of 1880, Eastman hired a loft, bought a secondhand two-horsepower engine and set up shop. He had hesitated about purchasing the engine because of its size, but justified his action by saying, "Perhaps the business will grow up to it." He worked in the bank during the day and in the loft at night, manufacturing dry plates, until Henry Strong, a buggy-whip maker and one of Mrs. Eastman's boarders, advanced him $5000. Eastman resigned from the bank. The two men formed a partnership and organized the Eastman Dry Plate Company.

They had no difficulty in selling their product and, as business improved, more workmen were hired to join the six original employees. Suddenly, however, photographers began complaining that Eastman plates were not sensitive. Tests showed that the formula being used no longer produced a satisfactory emulsion. The partners closed their factory and Eastman mixed 450 batches, but none had any value. Eastman and Strong decided to go to England, then the photographic center of the world, and see if British experts could help them with their problem. Overseas, they learned that it was the poor quality of the gelatin they were using that was causing the trouble. The partners returned to Rochester, where they resumed production. They re-established confidence by replacing all the defective plates made by the faulty process.

There were no more complaints and, by 1884, larger manufacturing space was needed. The company moved into a four-story building on the site of the present-day Kodak Tower, the skyscraper headquarters of the firm. Meanwhile, Eastman was seeking for a better way of taking pictures than with bulky and breakable glass plates. His experiments and the organization's expansion led to the formation of the Eastman Dry Plate and Film Company. Twelve others joined Eastman and Strong as shareholders in the new corporation, and the original partnership was dissolved.

With one of his new associates, William Walker, an engineer, Eastman developed a negative paper, hoping that it would replace dry plates. It could be used in rolls, which permitted several exposures to be made without reloading the camera and was far lighter than glass. However, the grain of the paper frequently showed in the pictures, which were developed in hot castor oil.

"A lot of failures often lead to success," Eastman told Walker, and went back to experimenting. The result was "American Film." Totally unlike the film of today, it used paper as a support for the emulsion—the paper was peeled off in warm water and the sensitized but insoluble gelatin developed. With Walker's help, Eastman also invented a holder for this film, which soon dominated the professional market.

Eastman, the manufacturer, was still an enthusiastic photographer, and he was convinced that everyone should be able to take pictures. Therefore, although he was pleased with the sales figures of American Film, he set out to create "a complete system of photography." His idea was to supply photographic material in large amounts at the lowest possible cost to the greatest number of people.

Because he had to manage the plant and was constantly devising labor-saving machinery to lower production costs, Eastman found it impossible to spend as much time as he wished on research. Therefore, in 1886, he hired a chemist to assist him in the quest for a flexible, transparent film base. Yet, busy as he was, Eastman had time to create a trademark for his products. He wanted a word "that was short, and easily spelled and pronounced in any language." As "K" was his favorite letter, Eastman finally chose "Kodak."

Kodak became world famous and Eastman the father of popular photography in 1888, when the No. 1 Kodak camera was introduced. Sold for $25.00, it contained enough American Film for one hundred exposures. After all the pictures had been taken, camera and exposed film were sent to Rochester by the owner. Here the film was developed, prints were made and the camera was reloaded—all for $10.00. Eastman, who wrote his own advertising, coined the slogan, "You Press the Button, We Do the Rest." Before long, Kodaks were known all over the world for, as Dr. Edwin Seligman once wrote, "Mr. Eastman was the first manufacturer in the United States to formulate and put into practice the modern policy of large-scale production at low costs for a world market, backed by scientific research and extensive advertising."

Although an improved Kodak was offered the following year, the outstanding Eastman development was the invention of the world's first commercially successful transparent, flexible film on rolls—the result of treating nitrocellulose with thousands of different solvents until one was found that produced a clear, grainless negative base. Photographers were delighted with this new product. Thomas Edison, learning that the film could be manufactured in strips two hundred feet long, ordered some and used it to make the first motion pictures, thus creating a new industry.

The "revolution in photography brought about by the devotion of a bank clerk amateur" had only begun. Always seeking a means of simplifying the taking of pictures, Eastman introduced one innovation after another—daylight loading film; a collapsible camera that fitted in a pocket; the Brownie, a camera designed for children which sold for $1.00; non-curling and nonflammable film; and dozens of other items that were constructed in plants throughout the world as well as in Rochester, making the Eastman Company the largest manufacturer of photographic products.

The onetime messenger boy was now an extremely wealthy man. Yet despite his success, Eastman modestly avoided publicity and would rarely allow his picture to be taken. Rich beyond his dreams, he recalled his struggle with poverty and established a retirement fund, life insurance and a disability benefit plan for his employees, with whom he also shared profits—being one of the first industrialists to reward workers for loyalty.

As he grew older, Eastman hired experts to assist him, and this gave him leisure to hunt, fish, travel and listen to music, which he greatly enjoyed, although he himself could not play a note. Sunday evenings, he would invite guests to a concert in the fifty-room mansion where he lived with his mother, who still knitted his socks as she had when George was a boy. Out of these musicales came Eastman's gift of millions to the University of Rochester to establish a School of Music.

Although Eastman liked the company of women, he never married. However, he was not a lonely bachelor. George had many friends: some were famous in the arts and sciences; others native guides he had learned to know well in the jungle; still others prominent figures in the worlds of politics, business and education.

In addition to his Georgian-style home, Eastman bought a 2000-acre hunting preserve in North Carolina, where he always acted as chef. He also cooked while on safari in Africa where he shot a huge bull elephant. The beast had only one tusk but Eastman told his guide, "Don't worry about it. I'll have another one made." He did—and it was impossible to tell the real from the imitation!

Eastman gave the University of Rochester, Hampton and Tuskegee Institutes, and the Massachusetts Institute of Technology $50,000,000 in 1924. After signing the checks, he exclaimed, "Now I feel better." This was not his first gift to M.I.T. Grateful for the fine young scientists that institution had sent him, he had, for some years, been donating large sums to its scholarship fund under the name of "Smith." The undergraduates celebrated their mysterious benefactor in song:

Hurrah! Hurrah! for Tech and Boston Beans
Hurrah! Hurrah! for "Smith" who'er that means.

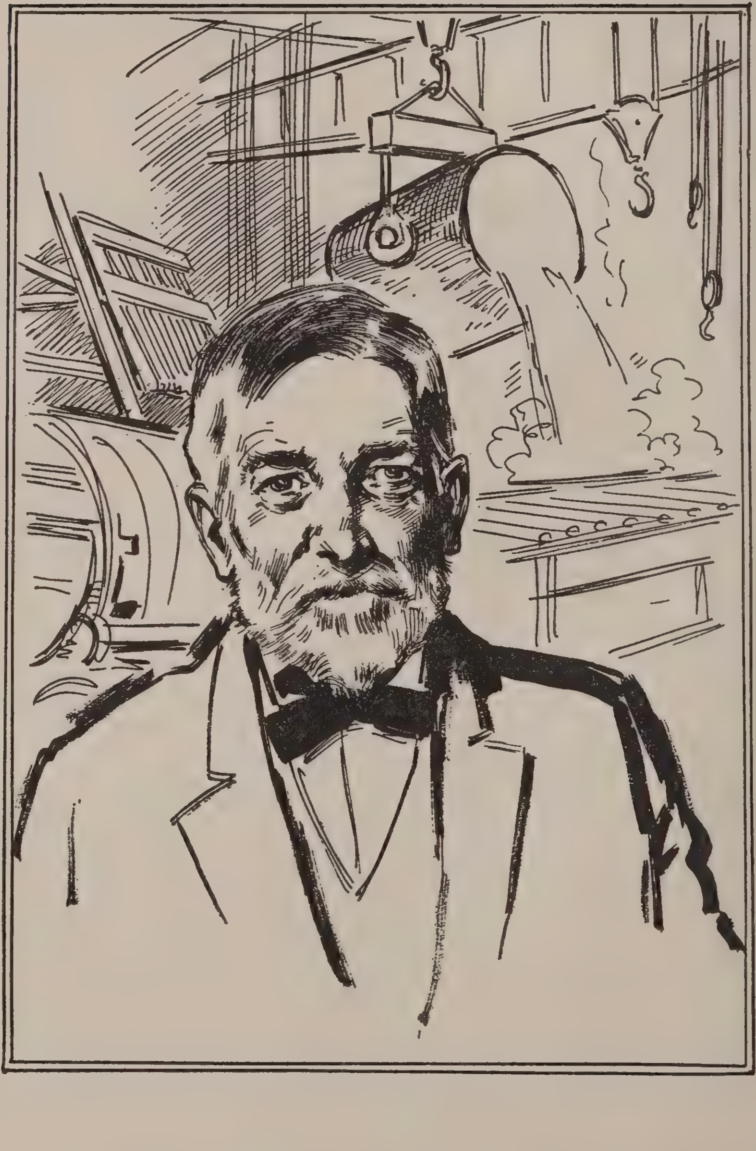
Bothered with bad teeth as a child, Eastman endowed dental clinics all over the world. Altogether he gave away $80,000,000 during his life. Yet he still kept his account book, and carefully recorded how much milk his cows were yielding, the amount of butter made from it, the number of eggs laid by his hundred chickens and the weight of the vegetables picked in the garden.

Up to 1930, Eastman took an active interest in his business, hobbies and philanthropies. From then until his death in 1932, the man who had brought photography within the range of everyone was obliged to curtail his activities because of ill health.

Although never lacking in determination while experimenting, or courage while stalking big game, his gentle nature had made him as willing to compromise as to fight with his competitors. Strangely enough, Eastman, who gave millions to organizations in his native city, never took an active part in civic affairs. Perhaps it was because he was so used to working alone that he disliked serving on committees. A quiet man, friendly, yet happiest when by himself, he desired no honors or publicity.

Andrew Carnegie

1835-1919



Andrew Carnegie

1835-1919

UNTIL the Industrial Revolution, Dunfermline, the ancient capital of Scotland, was a thriving town, the fine damask woven by its residents having made it world famous. However, the shift from hand-operated to steam-driven looms brought poverty to many families. Among these were the Carnegies, who decided to migrate to America in 1848 and set up looms in Pittsburgh, where they had relatives. But there was little demand for hand-loomed cloth in that city, and soon the Carnegies were in worse circumstances than they had been in Scotland. In fact, if Mrs. Carnegie, who had learned the trade from her father, hadn't become a shoemaker, they would have starved.

Family finances improved when thirteen-year-old Andrew became a bobbin boy in a cotton mill. He worked twelve hours a day for $1.20 a week, but received an 80-cent raise for running a steam engine and firing the furnace. On hearing that the local telegraph office paid messengers $2.50 a week, Andrew applied for a job and was hired. While young Carnegie impressed his superiors with his willingness to work, he was not popular with the other messengers, for Andrew took more than his share of deliveries beyond the city limits, for which the boys received extra pay. Moreover, instead of buying candy with his tips, as they did, he saved them.

Carnegie did not pay for his recreation. He spent his leisure time reading in the private library of one of Pittsburgh's leading citizens who was interested in young people.

Anxious to learn telegraphy, Andrew reported for work early each morning so that he could practice. By the time he was seventeen, Carnegie was an excellent operator and frequently sent messages for Thomas A. Scott, superintendent of the Pittsburgh Division of the Pennsylvania Railroad. Impressed with Carnegie's skill, Scott hired him as his private operator in 1852. Seven years later, when Scott became vice-president of the road, Carnegie was given Scott's former post at a salary of $1500 a year. It was a most responsible position for a young man of twenty-four, but Carnegie proved capable. Once, when snow blocked the line, he stayed on the job for a week without changing his clothes, until the tracks were clear.

While working for the Pennsylvania Railroad, Carnegie invested money in many different enterprises—oil, stocks, a grain elevator, an iron business and a locomotive works. However, his greatest profit at this time grew out of a chance meeting with T. T. Woodruff, who explained his scheme to supply railroads with sleeping cars. Before the two separated, Carnegie had acquired the right to purchase a share in Woodruff's company in return for promoting his invention. Although he had to borrow money to buy the stock, Carnegie made a fortune in this venture, for not only did he negotiate an agreement between Woodruff and George Pullman, who was also manufacturing sleeping cars, but he so maneuvered matters that he became the largest shareholder in the new company. No wonder the poor weaver's son was convinced that, "Business is the greatest game in the world."

Borrowed money also made it possible for Carnegie to buy a one-fifth interest in the Keystone Bridge Company. This interest also returned huge profits, for Keystone replaced many old wooden bridges with iron structures and built others in places formerly served by unreliable ferry boats. In fact, everything in which Carnegie invested prospered. One reason was that, in each case, he showed an uncanny ability to pick the right partners and hire the ideal man for the job. Years later, he explained, "I did not understand machinery, but I tried to understand that much more complicated piece of mechanism—man." His knowledge of human nature had begun very early in life. As a child in Scotland, he'd no difficulty gathering grass to feed his rabbits—friends did it for him in return for the honor of having the bunnies named for them!

While he understood men, he also had an eye for detail. "I believe," he said, "in putting all my eggs in one basket and then watching that basket." When he secured control of a steel mill, he was horrified to find that there was no accounting system—no one knew what each process cost, the duties of the various employees, if waste could be avoided or if ore received weighed the proper amount. Within days, all this was changed. Upon establishing a pig-iron plant, Carnegie hired a chemist to oversee the removal of harmful sulphur and phosphorus from the ore—the first to be so employed.

Although Carnegie wanted to "concentrate upon the manufacture of iron and steel and be a master in that," he did become interested in the infant petroleum industry. He took an option on some land near Oil Creek, Pennyslvania, for a few thousand dollars—an investment that was to bring him five million!

In March, 1865, although Carnegie was offered the post of assistant general superintendent by Scott, he resigned from the

Pennsylvania Railroad to devote all his energies to his ever expanding interests. It was well he did, for difficult times were ahead. The end of the Civil War brought about a business slump, and a series of steel strikes swept the country. However, the "Carnegie Luck," which his competitors often credited for his success rather than his ability, not only kept him from bankruptcy but added to his wealth. A strikebreaker, imported from Germany, told his employer about a mill that rolled steel plates of various widths, with finished edges. Carnegie immediately saw the advantage of such a mill, constructed one and soon was doing more business than ever before.

Andrew Carnegie did not rely on salesmen to sell his new product. An experienced railroadman, he watched what the various lines were doing, anticipated their needs and called on purchasing agents himself. In 1867, he decided to go to New York in order to be near the great financial houses and home offices of many railroads. Three years later, when he was thirty-five, Andrew Carnegie's annual income was $50,000 a year and he thought seriously of retiring.

Retirement was impossible for him, though. Whenever he heard of a steel mill for sale, he acquired it, reorganized operations and modernized equipment. Yet, strangely enough, at first Carnegie had little faith in the Bessemer process—the blowing of cold air into molten iron to refine it. However, while touring Europe, he visited several plants using this method, changed his mind and, on returning home, converted to the Bessemer technique.

Foreseeing a tremendous demand for rails by the nation's railroads, Carnegie built a steel-rail mill on the site of Braddock's defeat by the French and Indians in colonial days. Thanks to Carnegie's flair for publicity and his friendship with purchasing agents, the project was a success from the start.

To celebrate, the steelmaker took a trip around the world. As a going-away gift, his mother presented him with a copy of Shakespeare. Carnegie was delighted, for ever since he had stood backstage as a messenger, listening to the great actors of the day in the theaters of Pittsburgh, Shakespeare had thrilled him. He resolved to memorize part of a play everyday and, by the time he arrived back home, he could quote thousands of lines.

In 1881, Carnegie made another trip to Europe, touring the continent in a coach-and-four. The highlight of this vacation was driving in style into Dunfermline with his mother—for as a boy he had promised her, "Someday, I'll take you back to Scotland and you'll ride into town in your own carriage."

Back in America, Carnegie realized that the Homestead Steel Mill had been built for the express purpose of ruining him. Characteristically, he said nothing, but quietly set about acquiring control of Homestead, which, in time, became one of his most profitable holdings. There was good reason. Homestead dug iron and coal from its own mines, transporting them, either by a fleet of company-owned Great Lakes steamers or by a private railroad line 425 miles long, to the plant. Here the ore was smelted with coke made in Homestead ovens and with limestone from Homestead-operated quarries.

Although Carnegie set up a bonus and piecework system at Homestead, the mill was the scene of one of the most bitter strikes in American labor history. However, Homestead and the rest of Carnegie's enterprises continued to prosper and, when the Carnegie Steel Company, Limited, was organized in 1892, it was the greatest steel and largest coke manufacturing business in the world.

Carnegie remained a bachelor until his mother's death. Shortly afterward he married Louise Whitefield, who had been a friend for many years. She was an ideal companion for the steelmaker and, when he retired, helped him plan the best methods of giving money to worthy causes.

Now an extremely wealthy man, Carnegie built a mansion on New York's Fifth Avenue. It was beautifully decorated, but perhaps its most unusual feature was the marble over the fireplace, on which a book and these words were carved: "He that cannot reason is a fool. He that will not is a bigot. He that dare not is a slave."

Carnegie also bought 700-year-old Skibo Castle, on Dornock Firth in Scotland, where he set out a golf course and installed an organ which was played while he ate breakfast. At Skibo he lived like a laird. He was awakened by swirling bagpipes, read Burns and danced reels by torchlight. Yet despite the fact that he was enjoying himself, he never forgot business. Asked by an English newspaper to write an article for which he could name his own price, Carnegie demanded $5,000,000. This was, he told the editor, "far less than the knowledge cost me."

He needed all his knowledge to meet the competition of the newly formed United States Steel Corporation. Secretly, however, he was truly ready to retire, although he threatened to build new plants and drive U.S. Steel out of business. The bluff worked, and he was bought out for $500,000,000. Carnegie had but one regret—he was positive that if he had only held out a little longer, he would have been paid more!

Now Carnegie had a new ambition—to die poor. He began to give money away with the same zest he had shown in accumulating it. Because he hated war, having seen its horrors while helping Scott load wounded on trains after the battle of Bull Run, he established a peace society and built the Temple of Peace at The Hague, in the Netherlands. Although Carnegie received only five years of schooling, he had a great respect for education, so he established institutes in Pittsburgh and Washington, D.C., "to conduct, endow and assist investigation in any department of science, literature or art." He also endowed colleges and universities; started pension funds; provided rewards for "heroic acts in time of peace"; presented churches with organs and set up the Carnegie Foundation for the "furtherance of civilization."

Of his many benefactions, Carnegie enjoyed building and equipping libraries all over the world the most, for he recalled what the opening of Colonel James Anderson's private library to "working boys" of Pittsburgh had meant to him. As a result, nearly three thousand libraries were financed by him, under an arrangement by which local authorities provided the site for the building and its maintenance.

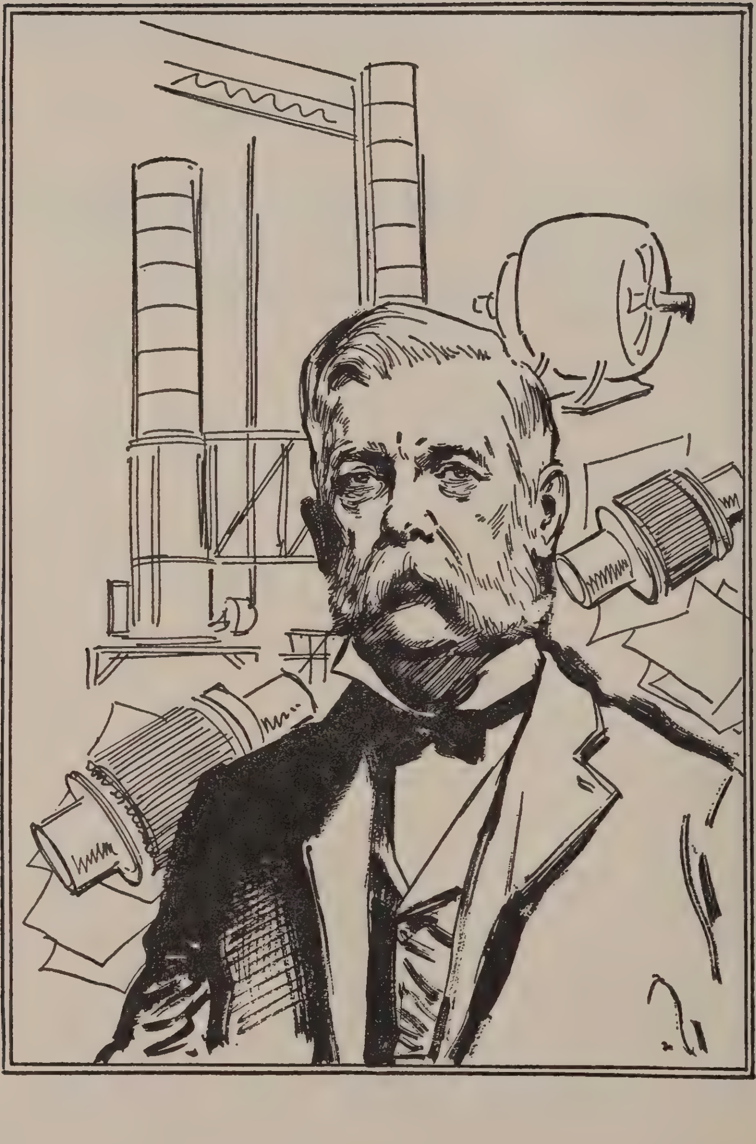
In 1916, Carnegie bought *Shadow Brook* in the Berkshire Hills of Massachusetts. The second-largest private dwelling in the United States, the music room alone could hold five hundred people. Here he brooded over the war that was sweeping Europe, read the reports of the remarkable foundations he had established, listened to his piper and organist and took catnaps in his easy chair.

On August 11, 1919, Andrew Carnegie, the last man to dominate a single industry, died of bronchial pneumonia. He had achieved all his ambitions save two—he had not brought peace to the world and he did not die a poor man. His estate was worth slightly over $22,000,000.

Despite Carnegie's imaginative resourcefulness and impatient energy in business, he had been very romantic, and delighted in poetry, music and art. While his competitors found him stiff and unbending, he had enjoyed the friendship of men in fields far removed from blast furnaces. Although justly proud of his achievements, he insisted that his tombstone read, "Here lies the man who was able to surround himself with men far cleverer than himself."

George Westinghouse

1846-1914



George Westinghouse

1846-1914

"If someday they may say of me that in my work I have contributed something to the welfare and happiness of my fellow men, I shall be satisfied."

This quotation, inscribed on the bronze tablet beneath the bust of George Westinghouse, father of American power generation, in the Hall of Fame for Great Americans at New York University, sums up the modesty of this inventive genius who was granted 361 patents, an average of one every month and a half of his working life. He founded sixty companies whose products lessened the labors of man by putting electricity to work, and he was responsible for the creation of scores of new occupations.

Westinghouse inherited his mechanical ability from his father, a manufacturer of farm machinery. In 1856, Mr. Westinghouse sold his farm in Central Bridge, New York, where George had been born, and moved to Schenectady, where there was a greater market for his products. After school, his son assisted him, much preferring the shop to the classroom. In fact, George did so poorly in school that one of his teachers told his parents that he was "dull and backward." The boy might have been slow in school, but not in the shop. When he was thirteen, his father, seeking to keep George busy for a week, ordered him to cut a pile of metal pipe into equal lengths. To his amazement, the job was done by noon—his son had fashioned a power tool which automatically fed and cut the pipe in a few hours.

Two years later, George ran away from home, hoping to join the Union Army, but was taken off the train by his father. However, when he was seventeen, Mr. Westinghouse consented to his enlistment and George became a scout in the cavalry. After serving for some months, he was discharged in order that he might accept the post of third assistant engineer on a naval vessel. While Westinghouse carried out his duties in shipshape fashion, he smuggled a lathe aboard and built an engine in his spare time.

After the War Between the States, George returned to Schenectady and enrolled in Union College. He did exceptionally well in mathematics and mechanical drawing, but paid little attention to the rest of his courses and was asked to withdraw. Westinghouse's parents deeply regretted his leaving college, but their disappointment in their son turned to pride when, three weeks after celebrating his nineteenth birthday, he received his first patent. It was for a rotary steam engine that he had designed. He won nine more patents before he reached thirty.

George was now working full time in the shop, and often went on business trips for his father. While returning from one of these, he saw a crew of workmen straining to pry the cars of a derailed train back on the tracks. As he watched, Westinghouse conceived the idea of a car replacer—a pair of rails clamped to the track and run off at an angle against the wheels of the nearest derailed car, which then could be hitched to an engine and drawn back to the main track. He told his father of his scheme, but Mr. Westinghouse thought it of little merit. So George borrowed $5000 from two businessmen and the trio began manufacturing car replacers.

Once the replacer was selling, George felt he could afford to get married and proposed to Marguerite Walker. An ideal mate for an inventor, she knew when to leave George alone and when to insist that he go fishing. When their only son, George Westinghouse III, was old enough to bait his own hook, the electrical genius needed little urging to take time off to teach the youngster to land the big ones—but all too often father and son came home empty-handed and told about "the big one that got away."

It was an incident that happened on a trip which led to George's perfecting "the most important safety device ever known"—the air brake. Thrown to the floor when the train in which he was riding stopped with a jolt, Westinghouse inquired what the trouble was. The conductor pointed up the track which was strewn with the wreckage of two trains that had collided. As he assisted in the rescue work, George learned that a separate hand brake had to be applied to each car to stop a train. This meant that even though all brakes worked, crashes were frequent because a fast-moving train would travel as much as a mile before the crew could rush from car to car and set them. To Westinghouse, the solution was simple—a brake controlled by the engineer which would stop a train instantly.

Whenever he could spare time from making car replacers, George drew designs of such a brake. Meanwhile, his partners decided to withdraw from the business. Westinghouse moved to Pittsburgh and made arrangements with a steel plant to manufacture the replacer. Then he returned to the problem of making a railroad brake. He experimented with compressed steam, built a miniature train to see if a long chain running under the cars would work, and tried dozens of other methods. None of them were satisfactory. Recalling that compressed air had been used to operate the rock drills in building tunnels through the Alps, he used this as the activating medium to set his brake—and it worked perfectly.

Although the 22-year-old inventor had developed a method of stopping trains quickly, no railroad executive would listen to him. One, calling him a fool, threw him out of his office bodily. Finally, the Panhandle Railroad consented to run a test on the device. Westinghouse, it was understood, would pay all expenses.

In April, 1869, the first train equipped with air brakes pulled out of Pittsburgh for Steubenville, Ohio. Aboard were friends of Westinghouse, railroad officials and the anxious inventor. Just as the train gained full speed, it stopped short, scattering everyone on the floor. The passengers scrambled to their feet, prepared to tell Westinghouse what they thought of his brake—but could not find him. George had rushed to the cab to see what was wrong. Nothing was wrong, for his air brake had passed a practical test. On the tracks, just a few feet in front of the cowcatcher, lay a teamster thrown there by his horse after his wagon had been caught in the tracks.

A month later, a patent was granted on the air brake and, shortly afterward, the Westinghouse Air Brake Company was organized. In 1870, Westinghouse went to Europe to introduce his invention and came home with a suitcase full of orders, which, added to those from American railroads, kept his employees busy. However, no one worked for Westinghouse on Saturday afternoon, for, as a boy, he had promised himself that, if he ever became an employer, his help would have a half-holiday every week so that they could go to picnics and ball games. Just as his closing down at noon Saturday became an universal practice in industry, so did many of the other benefits Westinghouse gave his workers: pensions, vacations with pay, sickness and accident insurance, student training courses, and incentive plans of work. Always considerate of his workmen, Westinghouse provided model homes for them, which they could either purchase or rent for very little money, when he moved the air-brake plant to a new site in Wilmerding, Pennsylvania. Most other industrialists would have erected cheaply constructed houses close to the factory and charged excessive rentals.

Between 1876 and 1886 Westinghouse produced many inventions and organized companies to manufacture them. Among his creations were an automatic telephone-exchange system, electric signals that did away with the unreliable manually operated equipment used by railroads to control traffic, a method of transmitting natural gas through pipes, and a natural gas meter. The last two meant that this inexpensive fuel could be used by customers vast distances from the source of supply.

Westinghouse's invention of a reducing valve, which permitted gas taken at high pressure from wells to be delivered at low pressure at the point of use, was indirectly responsible for the formation of the Westinghouse Electric Company. George realized that, if he could develop a "valve" for electricity as he had done for gas, alternating current could be transmitted for miles at high voltages and then reduced where used. This would mean the creation of dozens of new industries to make, install and service electrical appliances. Westinghouse felt that direct current was retarding the widespread use of electricity, because its voltage cannot be raised or lowered and therefore can only be used near where it is generated. Moreover, to transmit direct current long distances, it has to be generated at such high voltage that it is of little value to most users.

What Westinghouse needed was a transformer—one of the simplest of electrical devices. It has no moving parts, yet can "step up" or "step down" voltage as required. Hearing that two Europeans had invented a transformer, he bought the patent rights for $50,000, but, upon testing it, was dissatisfied with the way it worked. Turning to his desk, Westinghouse made a rough sketch, handed it to his assistants and ordered them to redesign the transformer according to his drawing. Three weeks later, the job was done. The transformer through which current passes into most of the homes and factories of the United States today is basically the same as the one he designed.

William Stanley, one of Westinghouse's associates, took the redesigned transformer to Great Barrington, Massachusetts, for a practical test. For weeks, Stanley climbed the elms on Main Street, stringing wires. He also placed lamps in the windows of offices and stores. Then on a March night in 1886, Stanley flicked a switch and the little town nestled in the Berkshire Hills became the first community to be lighted with alternating current.

No one loved the struggle and battle of the business world more than Westinghouse, who was confident of his ability and positive he could accomplish anything he set out to do. Normally polite and smiling, George was a different person when dealing with those who were trying to prove his ideas impractical. Nikola Tesla, his long-time associate, once said, "He was a giant when confronted."

Although about one hundred Westinghouse-built alternating current plants were operating in America within two years, the direct current system backed by Edison was in far greater demand, and it appeared that Westinghouse would lose the "war of the currents." He won a skirmish in 1893 when he received the contract to light the Columbian Exposition in Chicago. But there was one difficulty—the Edison interests controlled the only workable incandescent electric light bulb and refused to let Westinghouse use it. Working day and night, he finally perfected the "stopper lamp"—so called because a piece of ground glass holding an iron filament fitted into the bulb like a cork. Because it was made in two pieces, it did not infringe on Edison's patent. Westinghouse hastily erected a glass factory and, on the night the Exposition was officially opened, 250,000 "stoppers" glowed brilliantly. Westinghouse frankly admitted that his bulbs were not as good as Edison's, but they made it possible for him to advertise alternating current and realize a profit on his contract, in spite of the low bid he had tendered.

The last major battle in the "war of the currents" was also won by Westinghouse when he was given the contract to convert the water power of Niagara Falls into electricity and transmit it overland by alternating current. This was a major victory, for before the contract was awarded, an International Commission, composed of scientists from many countries, had publicly expressed the opinion that direct current should be used. At three seconds after midnight, November 16, 1896, all opposition to alternating current vanished when the city of Buffalo, New York, twenty-two miles from the Falls, received electricity from the polyphase generator that Nikola Tesla and Westinghouse had installed beside the Niagara torrent. The polyphase system, incidentally, permits the operation of motors at constant turning effort, which in turn makes possible the universal use of alternating current in industry.

Seeking power to turn generators inexpensively where there was no available water power, Westinghouse engaged in thousands of experiments, for, even though he manufactured the largest and finest steam engines in the world, he knew their limitations. In his search, he tried natural gas and, although he developed a 300-horsepower engine, a by-product proved more valuable than the motor—the discovery of a process for extracting gas from soft coal. Eventually, he built a steam turbine generator, which, in its present-day form, supplies most of the electricity used in this country. Westinghouse also, aided by his staff, designed a steam turbine to propel ships—a task that took six years. Meanwhile, he proved that alternating current was as practical in transportation as in industry by manufacturing locomotives powered by alternating current.

Over the years, Westinghouse established branch plants in Canada and in Europe, thus providing work for tens of thousands and bringing the benefits of his inventions to millions. Internationally famous, Westinghouse received medals from engineering societies in many lands, was decorated by foreign governments, and received several honorary college degrees—including a doctorate from Union College where he had done so poorly as a young student of nineteen. While grateful for these awards, Westinghouse himself was not satisfied with what he had accomplished. "I don't think of the past," he once said, "I think of what I am going to do tomorrow."

He always found plenty to do, but occasionally would sneak away to go fishing on his estate in Lenox, Massachusetts. During one of these infrequent periods of relaxation, his boat sank and he was nearly drowned. Westinghouse said nothing about the incident until late that night, when he was seized with a chill and began coughing. Complications set in and he was bedridden for weeks, but finally was able to spend a few hours each day in a wheel chair. He resented having to rely on someone to push him about so that, when George Westinghouse died on March 12, 1914, clutched in his hand was the design for a motor to power a wheel chair.

Henry Ford

1863-1947

Henry Ford

1863-1947

SLIDING the barn doors shut, William Ford turned to his son and said, "Very well, Henry, go to Detroit and become a mechanic, but I'm sure no good will come of it."

How wrong he was! Because Henry Ford did go to Detroit, America became a nation on wheels. The moving assembly production line for automobiles was perfected, the interchanging of parts standardized, many other new techniques in manufacturing developed, and thousands of new industries came into being to supply parts and materials to Ford's own business—one of the most successful enterprises the world has ever known.

Mr. Ford had long known that his sixteen-year-old son wanted to become a mechanic. Henry was always tinkering with machinery, helping the local blacksmith, doing carpentry work, repairing his neighbors' tools and buying more equipment for his workshop with the money they paid him. While the boy had no watchmaking tools, he could put most timepieces in running order with a bit of spring steel, a knitting needle and a nail filed down so that it could be used as a screw driver.

Even in elementary school, young Ford had shown more interest in mechanical things than in books. Under his supervision, his classmates dammed a creek near the schoolhouse and set up a water wheel . . . instead of turning paddles, as the youthful engineer expected, the water backed up and flooded nearby fields! Curious about the power of steam, Henry tied down the lid of a kettle, placed it on the fire and waited to see what would happen. The explosion not only burst the kettle, but scalded him. A steam engine constructed with the aid of his chums also exploded and burned down the school fence. These mishaps taught Ford a lesson he never forgot—to consider the possible outcome of any experiment before starting it.

In December, 1879, Henry began working for a Detroit firm that made railroad cars. Fired six days later because he "got into trouble babbiting a box," he became an apprentice in a machine shop. Ford's salary was $2.50 a week, but as his room and board cost $3.50 weekly, he had to take a part-time job to balance his budget. He repaired watches in a jewelry store four nights a week, receiving fifty cents an evening.

After working nine months, Ford resigned his daytime job and joined a firm that specialized in making engines for Great Lakes steamers. Although the pay was only $2.00 a week, Henry felt that the education and experience was worth the loss in salary. Seeking some means of increasing his income, he experimented in making an inexpensive watch. Eventually, he developed one that could be manufactured for thirty cents. He also made a watch that registered both standard and sun time, but neither was ever commercially produced.

In 1882, Henry decided to go home and reopen his old workshop. In addition to doing general mechanical work, he operated a thresher that went from farm to farm during the harvesting season. In between jobs, he worked on the eighty acres his father had given him as a home-coming gift. Using the skills acquired in Detroit, Ford constructed a steam engine to pull stumps, and rigged a sawmill to cut cordwood and lumber. Although Henry was a very busy man, he always had time to try something new. One of his projects was the development of a light steam engine with a high-pressure boiler heated by kerosene that could be used as an all-round farm power plant. When finally forced to abandon the scheme, Ford was more fascinated than ever with the possibilities of a self-propelled vehicle. Determined to build one, but realizing that he did not have sufficient knowledge of electricity, Henry returned to Detroit in 1891 and went to work as an engineer with the Edison Illuminating Company, at a salary of $45.00 a month.

Two years later he was made chief engineer and raised to $100 a month. Now he could afford to construct a gasoline engine. Yet little of his pay went for materials. Most of his engine consisted of scrap metal. A one-inch gas pipe mounted on a plank served as a cylinder, part of a lathe as a flywheel, some fiber with a wire through the center as a spark plug. Ford began making his motor early in December, 1893. On Christmas Eve he hauled it into the kitchen, attached the spark plug wires to the light over the sink, spun the flywheel and the first Ford engine roared into action.

Five days later, he was working on a larger two-cylinder engine designed to power a "quadricycle." Made from discarded metal and with improvised tools, the vehicle was ready for testing in June, 1896. Starting the engine, Henry mounted a bicycle seat over the gasoline tank, pulled a lever and the Ford automobile "sputtered its way into history." Because crowds gathered and horses scattered in all directions whenever he drove along the streets, Ford had to get special permission to use the highways—thus becoming the first holder of an automobile license in the United States.

After improving his invention, Henry sold it for $200 and used the money to build another car, which he also sold. He then began a third with money advanced by friends who were impressed with the patent Ford had received for an improved carburetor. Thomas Edison was also impressed with Ford's ability. When the two met at a convention, the inventor of the incandescent bulb questioned Henry about his "horseless carriage" and advised, "You have it . . . keep at it!"

Edison's advice helped Ford to make a most important decision. In 1889, he was promised the general superintendency of the Detroit Edison plant if he would stop making automobiles. At the same time, the newly formed Detroit Automobile Company offered him the post of chief engineer and a block of stock for the use of his designs. Recalling what Edison had said, Ford accepted the latter proposition. Unfortunately, he could not get along with his associates and resigned to manufacture automobiles under his own name.

In order to get publicity, Ford built a racing car that won every contest in which it was entered. His name became so well known that a group of investors decided to finance him, and the Ford Motor Company was incorporated in 1903. The firm had no machinery and only seven employees, who assembled automobiles from parts made to order. Because sales exceeded production, more workers were hired and nearly a thousand cars were constructed the first year. However, there was very little profit due to Ford's constant changing of his car in hopes of improving it. His backers saw no reason for this. They also disagreed with Ford's contention that the company should have a one price, one model, policy, and his insistence that parts should be standardized so that they might be easily replaced when worn. Finally, Ford bought out his associates' interest and was able to concentrate on a light, but strong automobile, produced in quantity at a low price for a mass market.

He offered such a car to the public in October, 1908—the famous Model T, affectionately nicknamed "Tin Lizzie" by Americans. Though extremely light, it had a rugged frame of vanadium steel—the first commercial use of vanadium in this country—which made it capable of taking severe jolts without damage. Equipped with a novel transmission that required no skill to shift from one speed to another, "Lizzie" was as easy to drive as a horse. Moreover, the tall thin-tired wheels which kept the narrow body high off the ground made it an ideal automobile to travel the deep-rutted roads that crossed the country. Almost immediately, orders for the Model T were months ahead of production. While Americans bought Fords by the thousands, they told tall tales and made jokes about them. Typical was the story of a woman who picked up an empty sardine can outside a garage and looked about for an ash can. A mechanic noticed her and said, "Your Ford is pretty banged up, lady, but if you leave it overnight, we can fix it!"

Ten thousand Model T's—a record in the industry—were sold the first year. Ford moved his sixteen thousand employees into a plant considered by architects to be the world's most modern factory, but had little time to supervise their work. He was too busy in court, defending himself against a pool of automobile manufacturers who were paying royalties to George Selden, a Rochester, New York attorney. Selden had never made an automobile, but in 1870 cleverly entered a complicated patent that covered every aspect of "the production of a safe, simple, and cheap road locomotive" powered by an internal gasoline engine. The patent was so general that any manufacturer of automobiles could be accused of infringement unless he paid Selden a royalty. Ford, however, refused to do so. He also decided to prove Selden's claims were unjustified. When a lower court upheld the attorney, Ford's competitors warned the public of the legal dangers of buying a Model T. Henry met this move by posting a bond to protect his customers. Then he carried his fight to the New York Court of Appeals. In 1911, that body upheld his contention that his automobile did not violate the Selden patent.

Back in the factory, Ford began experimenting in methods to reduce the time it took to assemble a car. Recalling how meat was conveyed on a trolley in packing houses, he placed the case of his unique flywheel magneto on a moving belt which carried it past mechanics, each of whom performed one operation in assembling it. This system functioned so well, it was adopted in other departments. Soon a major bottleneck developed in the final assembly area—parts were coming along far faster than they could be used. Ford then ordered a husky young workman to walk down the factory floor between piles of parts, pulling a chassis behind him, and directed other workmen to walk beside him and construct together Model T's from the piles of parts as they went along. Now a car could be put together in eighty-three minutes instead of twelve hours and a half—Henry Ford had created the automobile assembly line.

Before long, no one had to pull a chassis along the floor—all manual handling had been done away with and Ford had more machinery per square foot than any other manufacturer.

Neither were there part piles on the floor. Belts carried the various parts to mechanics at a rate of speed determined by time studies. Moreover, the belts were so arranged that no employee had to stoop. The men stood in two lines, according to height, on either side of the belt, each doing a single task.

Ford analyzed every job before assigning workmen to their positions along the belt. If the job could be done by a handicapped person, one was hired. In addition to this classification, he also set up a bonus system which helped cut down labor turnover. Not that he had any trouble hiring help—in January, 1914, he shocked his fellow industrialists by announcing a basic wage of $5.00 for an eight-hour day, double that of the prevailing pay. However, he had no use for labor unions which tried to establish just how conditions for the working man should be improved. It was not that he objected to paying higher salaries, but Ford resented being told what he should do by outsiders.

Despite the fact that he publicly announced that he was against World War I, ran advertisements on the value of peace in newspapers, and headed a private peace mission to Europe which brought him nothing but jeers on both sides of the Atlantic, Ford's attitude changed when this country entered the conflict. Not only did he offer the government the facilities of his plant, but also large loans without interest.

Ford refused any profit on his government contracts and also saved the taxpayers money by avoiding waste, which reduced manufacturing costs on items ranging from steel helmets to ambulances. This was nothing new—in Ford's plants, scrap metal was used to make nuts and bolts and discarded paper was burned for fuel. His greatest wartime achievement was the building of a factory to make submarine chasers on an assembly line. They were pressed from sheet steel by machines that cut them to size, bent the metal into shape and punched holes for rivets. Spurred by the shortage of food in Europe, Ford began manufacturing tractors with which he had been experimenting since 1902. These machines made it possible for farmers to raise more crops.

After the war, Ford bought out the few stockholders who still held an interest in his company, paying $12,500 for each $100 they had invested! Now, with no one to take exception to his scheme of constantly lowering prices and his expansion policies, Ford began a research program and established plants in foreign countries. Told it was impossible to cast iron by an endless chain method and to roll plate glass on revolving drums, he accomplished both. The chief satisfaction Ford experienced from this achievement was that it meant a reduction in the cost of manufacturing a Model T and the saving could be passed on to customers.

Nevertheless, sales dropped in the early Twenties. One of the reasons was Ford's refusal to cater to the demand for bright-colored automobiles. When his dealers complained, he replied, "You can have a Ford in any color—so long as it is black!" This stubborn attitude, plus competition, made it necessary to lay off employees, idle machinery and put into effect dozens of minor savings, such as disconnecting telephone extensions. These economies, plus the brilliant idea of buying two hundred surplus cargo vessels for their scrap value and melting them down to make automobiles which were sold below cost, carried the company through this trying period.

Convinced that he could manufacture automobiles more cheaply if he controlled the sources of the raw materials involved, Ford bought coal fields in Kentucky and West

Virgina, purchased a railroad to carry the coal, acquired timber lands in Michigan and a fleet of Great Lakes steamers to bring ore from company-owned mines to Ford smelters. Foreseeing the possibilities of plastics, he planted twelve thousand acres of soybeans to provide the basic ingredients. Ford was also one of the first to investigate the potentialities of synthetic rubber, although he owned vast rubber plantations in Brazil.

Never a bookish man, Ford had startled educated people by stating, "History is bunk"; yet the development of American industry from the handicrafts of the pioneers fascinated him. Therefore, he established a museum and built Greenfield Village, in Dearborn, Michigan, to which he brought the homes, stores and tools of the workmen of earlier days. Included among the exhibits are the original cycle shop of the Wright Brothers, and the school from Sterling, Massachusetts, made famous by Mary's Little Lamb. Ford also bought Wayside Inn, setting of Longfellow's well-known poems, and restored it. Fearing that the "calls," music and steps of square dancing would be forgotten because of the changes that were taking place in rural America, he invited old-time country fiddlers to Dearborn and recorded their playing and knowledge.

Meanwhile, the Ford Motor Company was doing more business than ever. By 1926, Ford was the greatest individual employer of labor in the world. A year later, the colorful new cars of other manufacturers left the still black Fords sitting in the showrooms. Unwillingly, but with characteristic energy, Ford designed a new model, which meant discarding machinery worth $100,000,000, and built a new plant on the Rouge River. When the Model A came off the production line, it was as colorful and as stylish as its competitors.

Though the Great Depression closed twenty-six of the thirty-two Ford factories and most of the company's subsidiaries, an eight-cylinder automobile with a V-8 engine was placed on the market in 1931. Ford was confident that business would improve and wanted the improved car to be ready. An individualist, he wanted no government help or controls to bring this about and refused to subscribe to the provisions of the National Recovery Act, although they were designed to stimulate business.

Henry had married lively Clara Bryant in 1888, and for the rest of his life discussed all of his plans with her, nicknaming Clara the "Believer." To his delight, Edsel, their only child, showed a great interest in things mechanical, and the elder Ford shared his knowledge with his son. This, plus experience gained in the various plants, enabled Edsel to serve as his father's first assistant.

Henry Ford was a strange mixture—opinionated, he would rush into matters of which he had no knowledge, cause misunderstandings, create difficulties, find out he was wrong, then apologize and fail to understand why he was not forgiven. A true individualist, he insisted upon doing things his way or not at all. As a result, this genius who loved the past but prepared for the future, while respected, was rarely admired.

Gradually turning more and more responsibility over to his son, Edsel, Ford began to relax. However, with the outbreak of World War II, he spent much time in his office. In September, 1941, the company received a contract to build 400,000 airplane engines, but had no suitable facilities for making them. Ford solved the problem by turning the Rouge River plant parking lot into a factory, enclosing thirty-three acres in a fiberboard shell at a cost of $37,000,000. Ten months later, the 78-year-old industrialist saw the first engine assembled. That spring, he plowed up his soybeans and erected the famous Willow Run factory to manufacture bombers.

In creating, equipping, staffing and managing these plants, Ford had the able assistance of Edsel, who had become president of the firm. However, in May, 1943, Edsel died, and Henry Ford, at the age of eighty, resumed the presidency. He got up at 5:30 A.M., took a walk, ate breakfast, then went to Willow Run, where he inspected every department, checking the most minor details. From here he drove to the Rogue River plant, where he did the same thing. It was not until 1945 that he was ready to sit on the sidelines. In that year he turned the management of his three-quarter of a billion dollar empire over to his grandson, Henry Ford II.

Now he had time to listen to the many music boxes he had collected, to examine his antiques and to rest. On April 7, 1947, a severe rain storm caused the Rouge River to flood and cut off the electric power that supplied heat and light to the Ford home. Pulling on boots and donning a raincoat, Ford set out to see what had happened. He returned, tired but satisfied that the damage could be easily repaired, and went to bed. A few hours later, that most individualistic of geniuses, who had revolutionized manufacturing techniques, who understood machinery far better than he did men, and who had changed the habits of a nation, suffered a cerebral hemorrhage and died, as he had been born, by candlelight.

Harvey S. Firestone

1868-1938

Harvey S. Firestone

1868-1938

LIKE all farm boys in Columbiana, Ohio, Harvey Firestone enjoyed going to fairs. Although he was fascinated with the midway, marveled at the size of the prize pumpkins and thrilled to the music of the brass band, watching his father trade cattle and horses was the thing Harvey liked best of all. By the time young Firestone was fifteen, he could buy, sell or swap a horse with as much skill as his parent who, proud of his son's business ability, gave him a free hand.

Therefore, when Harvey was graduated from high school, Mr. Firestone gladly assumed the expense of a three months course at the Spencerian Business College in Cleveland. After finishing his studies, Harvey became a bookkeeper for a coal company in Columbus, and then a traveling salesman for flavoring extracts. He was very successful but when his employer failed, Harvey asked his cousin, a wealthy buggy manufacturer, to give him a job. Firestone did so well that he was placed in charge of the Detroit salesroom, where he became enthusiastic about the rubber-tired wheels that made riding smoother and speedier. However, he found them nearly impossible to sell, because they cost $40.00 more than those with steel rims.

Nevertheless, he did make one sale—to a mechanic who had made a "horseless carriage" and was building another that he knew would be too heavy for bicycle tires. Years later, this lone customer, Henry Ford, purchased thousands of tires from Firestone and became one of his closest friends.

Shortly afterward the buggy firm went into receivership, throwing Harvey out of work. He decided to go into business for himself, removing steel rims from carriage wheels and substituting rubber tires. In time, he was positive, motor-driven vehicles would replace those pulled by horses, so there would be a tremendous demand for rubber tires. He wanted to be ready to supply these. Two friends gave him financial backing and, with an investment of less than $3000, the Firestone-Victor Rubber Company was organized in Chicago.

There were two reasons why Firestone and his partners went to America's second-largest city. First, Chicago offered a promising market for their product—the cobblestoned streets were so rough, horses had to wear rubber shoes. Secondly, they had heard of a tire shop that could be bought cheaply.

The firm made no tires, but bought long strips of rubber molded around two strips of wire. The rubber was cut to size and the ends of the wire fastened together so that the tire would not slip off the wheel. Because a patent already covered not only the machine used to weld the wire, but also the process itself, Firestone applied for a license to hire one of these machines. His request was denied, so he bought a blowtorch to fuse the wires that held the rubber tire in place—a slow method, but it worked.

For a while Harvey Firestone didn't find much use for his blowtorch. Then, suddenly everyone wanted rubber tires! The partners secured a bank loan and bought another tire company. Then they merged with a firm that was suing them for infringing on an existing welding patent for using the blowtorch and, in 1900, the associates sold out their holdings for $1,254,000.

Harvey did not get his full share of this money, for his partners withheld a large sum because of technicalities. However, he did have enough cash to go to Akron, Ohio, the "Rubber City," and set up the Firestone Tire and Rubber Company, in August, 1903. While the firm had only a handful of employees and limited space in an abandoned machine shop, it did have a valuable patent assigned to it by one of Harvey's new associates. This was on a tire that had steel rods inserted crossways in the rubber, instead of wires running lengthwise. The rods were close together and extended sufficiently so that they could be caught on hooks inside the rim. Firestone called it the "Perfect Side-Wire Tire" and mapped out a sales campaign that stressed it as the only tire molded in a coil. Since the coil's diameter was smaller than that of the wheel, the rubber fitted closely to the rim. Moreover, unlike other tires, his had no wires to cut the rubber before it was worn out, while the crosspieces eliminated the tendency of the rubber—when subjected to a heavy load—to spread up over the rim, which cut it.

Advertising "A tire superior to any other on the market," Firestone soon found it was impossible to manufacture enough tires to meet the demand. Yet there were no profits—every cent went back into the business. In fact, in order to raise sufficient funds to expand his production of automobile tires, Firestone borrowed money and sold shares in the growing concern.

When he had accumulated enough capital, he bought a vacant foundry and six lots of land in South Akron, Ohio. Filled with secondhand machinery, the plant began operations in December, 1902. A month later, the company's ten workmen were producing forty tires a day. All were designed for use on heavy horse-drawn vans or on automobiles powered by electricity, steam or gasoline.

The books showed a profit of $71,043 the second year. The factory was enlarged, more workers hired and the future looked bright. Then, Firestone's application for a license to make clincher tires—they had concave sides with curved edges of hard rubber that hooked on to flanges on the wheel rim—was turned down by the combine that controlled the patent. Firestone's answer to this rebuff was a tire that could be clamped to the wheel by bolts which passed through the rim into metal plates riveted to the sides of the tire. Because its walls did not curve in like those of the clincher, the inner tube was not squeezed, which gave more air space. Moreover, a motorist no longer needed a crowbar to change a flat—just a wrench.

After testing his new tires, Harvey Firestone, hearing of Henry Ford's plans to make an inexpensive car, went to see him. Ford subjected the tires to a far more severe test, was satisfied, and gave their originator the first of many orders. Firestone celebrated by developing a rim that could fit almost any make of tire, then produced the "dismountable" rim. In 1908, an anti-skid tire was offered by Firestone and he shrewdly designed the die so that the heavy tread was molded to read, "Firestone Non-Skid."

The company's business kept pace with the rapid growth of the automobile industry, and more plants were erected. Because of the fluctuation in the price of crude rubber, Firestone bought a one-million-acre rubber plantation in Liberia, West Africa. When cotton became widely used in the making of tire casings, he acquired cotton mills in Massachusetts. Factories were also built in Canada, Europe and South America.

Firestone was one of the first men in the United States to foresee the lively future for coast-to-coast trucking. His "Ship by Truck" campaign not only led to the establishment of a new industry, it brought about better roads—and sold more tires. Most of them were "balloons," which made motoring far safer and more comfortable. These tires and others made by his company were produced by "push-button" techniques, for Firestone wanted to cut costs. He also wanted to sell as many tires as possible. Therefore, he set up a nation-wide system of retail outlets.

Not popular with his competitors because they held him responsible for cutting the prices of tires, Firestone was considered a "much overrated little man." Yet he managed to bring his ever growing enterprise safely through economic upheavals that drove others out of business; guided the Rubber Association of America during the crucial years of World War I; and engaged in legal battles over patents that benefited every tire manufacturer.

While Firestone's business competition might not be friendly, Henry Ford, Thomas A. Edison and President Warren G. Harding were. Together, the four would go on camping trips and sight-seeing tours—the resultant publicity did not hurt the sale of Firestone tires!

When tires did not sell well, as during the Depression of the Twenties, Firestone, unlike other tire manufacturers, did not wait for business to get better. He slashed his prices and moved his stock—his business philosophy being to put one's losses behind and start out anew.

On Easter Sunday, 1895, Harvey had married Isabelle Smith, whom he had met at a dancing party. Firestone was a devoted father to his six children, and his fondest wish was granted when all five of his sons rose through the ranks to important posts in the business he had founded, the eldest, Harvey, Jr., eventually becoming president.

Harvey was both feared and loved by his employees—and for good reason. He knew everything that was going on in the firm. Yet he shunned publicity, leaving speechmaking about the rubber business to others, while he quietly built up an empire for his sons. Unpopular with many, his imaginative mind and organizational genius made him the best-known man in the rubber industry—though he would have much preferred to be known for his prize cattle and greenhouse-raised orchids.

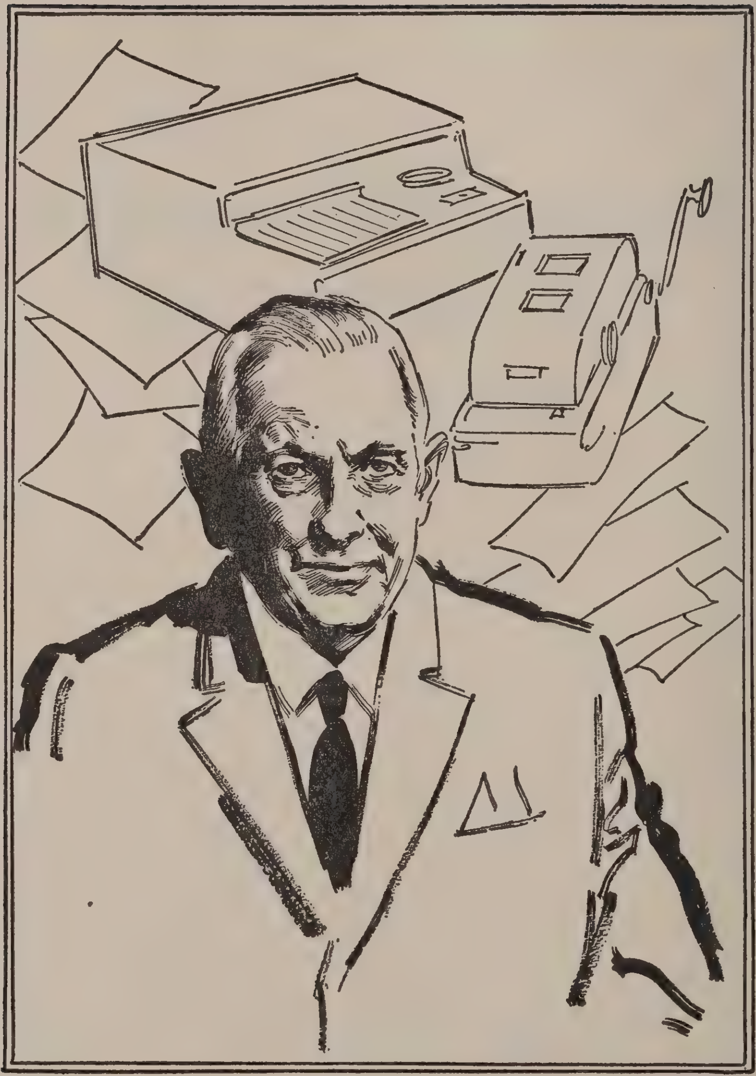
Early in 1932, Firestone resigned as president of his company—which now made many items beside tires, ranging from milk cans to rubber motor mountings—and became chairman of the board of directors. This enabled him to free himself of management details and to take a greater interest in the firm's ever widening activities.

From the first, Firestone had ruled his organization sternly. Yet he was a pioneer in industrial welfare: he built a home community for his employees, gave them a clubhouse, an athletic field and a 36-hole golf course. He also organized a bank and instituted a model stock-owning savings plan for his workers. As the company grew, Firestone had only one regret—he no longer knew the names of his help, whom he had once greeted personally every morning when he entered the plant. But now there were thousands of employees making rubber and steel products of many kinds, doing research in the laboratory, investigating boll-weevil control in southern cotton fields and working as salesmen. Although proud of this vast expansion, Firestone wistfully looked back on his earlier days in manufacturing and said, "I don't even know the names of my foremen. It used to be different."

When not in his office or in the field, Firestone could be found at Harbel Manor, near Akron. His home was located in the center of rolling Ohio farm lands, where he raised his prize cattle, pure-bred horses and orchids. He also had a villa at Miama Beach, Florida. It was here, on February 7, 1938, that Harvey Firestone, whose ingenuity and imagination helped America so much in making the transition from horse and buggy to automobiles, died quietly in his sleep.

Thomas J. Watson, Sr.

1874-1956



Thomas J. Watson, Sr.

1874-1956

THINK is the name of the monthly magazine published by the International Business Machines Corporation whose products—all of which enable men to work faster, more accurately and economically—range from typewriters to giant electronic "brains." The word also appears on the firm's stationery, on salesmen's notebooks, and on wall and desk signs in nearly one hundred different languages in the branch offices of this world-wide concern.

Like the brilliantly shined shoes, conservative suits, and starched white shirts with the stiff detachable paper collars of the IBM sales force and executives, this slogan originated with Thomas J. Watson, who made the company a giant in the business-equipment industry. "The expression, 'I didn't think,' has cost the world millions of dollars," Watson remarked, and he was determined that thoughtlessness would never cost his firm a penny.

Born in Campbell, New York, Watson attended the Elmira School of Commerce, although his father wanted him to study law. His first job was keeping the books in a market in the small village of Painted Post, New York, for which he was paid $6.00 a week. Watson considered himself fortunate to be employed, but he soon became weary of figures and decided he would be happier as a salesman.

His first selling assignment was to peddle sewing machines and musical instruments door-to-door. Watson's customers were farmers who usually lacked the cash to buy, but he was always willing to swap an organ for a horse, trade the horse for produce and then sell the produce to cover the cost of the organ.

When he was twenty, Watson, who was confident that he could sell anything, joined the sales staff of the National Cash Register Company and was assigned to the Buffalo, New York, office. For eleven days he tried to sell a register but couldn't—then he developed a sales technique that enabled him to move so many machines that the amount of his commissions shocked his superiors. At thirty-five Watson was appointed general sales manager of NCR, and in five years sparked a campaign that sold as many registers as the company had disposed of in the previous quarter of a century.

In the spring of 1914, Watson was offered the presidency of the Computing-Tabulating-Recording Company, in New York City. The firm was a small one, deeply in debt, with fewer than four hundred employees who made time clocks, butchers' scales and accounting machines. Feeling that an aggressive sales policy would solve CTR's difficulties, Watson accepted the post, after arranging that his salary would be based on the earnings of the company. Then he began a career that was to win him the title of "the world's best salesman."

His first claim to this title was staked out when he convinced a bank to lend $40,000 to the struggling company he headed—"The hardest sale I ever made in my life." Actually, CTR had no collateral for such a large loan, but Watson sold himself to the bankers. With the money, he built a laboratory to improve the few machines built by his firm and to develop others. Characteristically, he reserved $15,000 to spend on training salesmen.

From the beginning, Watson looked for new markets and catered to the special needs of customers. As a result, CTR's list of products grew. However, his most important job was selling salesmanship to his representatives and making sure that they never neglected to *think*. He drilled them to approach a customer with the idea that they were selling service, not machines. He taught them how each device worked so they could explain it simply while giving a demonstration, and, most important of all, he gave instructions in how to close a deal. A stern, but inspiring, teacher, Watson trained his pupils so well that, within two years, CTR was out of debt and paying dividends.

By 1924, Watson's investment in salesmen and research had so increased business that the company had three plants in the United States and branches in Canada and Europe. Because of this expansion, he changed the firm's name to the International Business Machines Corporation. Under his dynamic leadership, IBM's growth was an industrial phenomenon. An investor who bought one hundred shares of CTR in 1914 and took advantage of the right to buy additional stock when the company was reorganized under its new name, would have invested about $6000. Today his holdings would be worth more than two million!

Even the economic depression of the early 1930's failed to stop Watson. He met the slump by doubling his sales force and refusing to discharge any production workers. Although far more machines were produced than sold and the parts bins were overflowing, Watson reassured his associates, "don't worry, we'll use them to assemble machines when business gets better." When conditions improved, IBM, unlike firms that had retrenched, filled orders promptly by drawing on the stored parts—including the electric accounting tabulators needed by the United States Government to handle Social Security records.

By 1941, Watson's arrangement that his pay be based on a percentage of IBM's earnings made him the third highest-salaried man in the country. He asked for, and received, a reduction in wages, but still earned over one thousand dollars a day. During World War II, when IBM produced munitions, record-keeping systems, computing machines, top-secret coding devices and other equipment for the armed services, Watson not only limited the company's profit to less than 1½ per cent, but he requested that his share of this money be set aside to enhance the employees' retirement fund.

Watson, whose whole life was devoted to making and selling machines, always considered the individual far more important than things mechanical. He established free country clubs and bowling alleys for IBM's employees and set up a program of life, hospitalization and health insurance for them. A curriculum of courses, ranging from art appreciation to woodworking, was also made available to any member of the company. Because of this program, Nicholas Murray Butler, long-time president of Columbia University, called Watson "as great an educator as he is a business and industrial genius."

At Endicott, New York, where IBM's largest plant is located—there are six others in this country and fifteen in foreign lands—the firm spends several million dollars every year on education. To the classrooms come candidates for the sales force. Their schoolrooms are plastered with "Think" signs and such slogans as: "Aim High and Think in Big Figures"; "Serve and Sell"; "Pioneering Must Never Cease"; and

"There Is No Such Thing As Standing Still." On the steps leading to the main building the words: READ, LISTEN, DISCUSS, OBSERVE, THINK are engraved in gold.

These mottoes and commands stem from Watson's lifelong habit of jotting down his stray thoughts on a huge scratch pad mounted on an easel in his office. This trait, like so many others of "Mr. IBM," has been copied by company executives.

Incidentally, Watson never approved of the word "executive," and more than he did of "manager" or "supervisor." It was his belief that persons holding such positions would regard themselves as "assistants" to those under them. "Duties may differ," he said, "but all are working for the common good. The cornerstone of all values is the man himself, whatever his job." Watson also insisted on equal opportunities for both male and female workers, and set up a special education program for young women.

But Thomas J. Watson, the corporation president, was first and foremost a salesman, and it was the sales staff that received his personal attention. At sales conventions, he always stood by the door of the assembly room and shook every man's hand as he left. Watson also traveled thousands of miles annually to keep in touch with his men. In a two-year period, he covered 65,000 miles, visited 29 countries, and personally greeted 33,800 employees and members of their families from 51 countries. He explained that he was merely carrying out part of his theory of salesmanship: "Don't phone, don't write —pay the man a visit."

Busy as he was, Watson found time to take an active interest in world peace, education and art. At twenty-four, he bought a painting that cost him three weeks' pay and, as the years passed, he became one of the world's leading art collectors. Besides purchasing paintings for himself, Watson also acquired pictures for IBM. Sixty of these canvases were borrowed by the State Department and sent to foreign nations as an exhibit to help interpret America and Americans to the rest of the world. Watson also served as chairman of National Art Week in 1941.

Interested in international understanding, Watson was sure war could be eliminated if there were sound economic relations between countries. He suggested that nations which had vast natural resources share with those that lacked them. Elected president of the International Chamber of Commerce in 1957 for a two-year term, he was made honorary permanent president and popularized the slogan, "World Peace Through World Trade." Watson also did much to promote a program by which exchange students would live with families rather than in dormitories, feeling that this would bring about friendly international relations.

Because of his interest in world-wide affairs, Watson was the semi-official host to many foreign dignitaries while they were visiting New York. He did such an excellent job that President Franklin D. Roosevelt said, "I take care of them in Washington and I have learned to rely confidently on Tom Watson to take care of them in New York."

Although Watson won many awards for his work in industry, youth organizations, education and human relations, selling was still his main interest. Extremely active—at sixty it took four male secretaries to handle his volume of correspondence—he dominated IBM. Watson always got his own way. He never argued, but simply "didn't hear" anything he disagreed with by the method of concentrating on something else. Despite his heavy work load, he always had time to teach salesmanship, which he considered merely "talking with sincerity about a product or a service you believe in," and stressing "that in the final analysis, each salesman must think his own way to success." A polished speaker, his talks were always inspiring. "Don't," he told prospective salesmen, "worry whether you are starting out on your left foot or your right. All you have to do is get going and keep going—toward the place where the prospect is."

While he insisted that IBM salesmen know how the machines they sold were made and worked, Watson warned them to avoid lengthy technical explanations. Listening to one of his staff describe the mechanics of a punched-card device, he picked up a pencil, jabbed it through a piece of paper and quietly said, "This machine punches holes."

While salesmen are supposed to be hearty, fast talking and breezy, Watson the world's greatest salesman, had none of these traits. A dominating individual, he not only created IBM but also originated a code of behavior for his employees to follow in their personal and private lives—what he did and liked, they were to copy. He ruled over the firm like a stern, but kind, uncle.

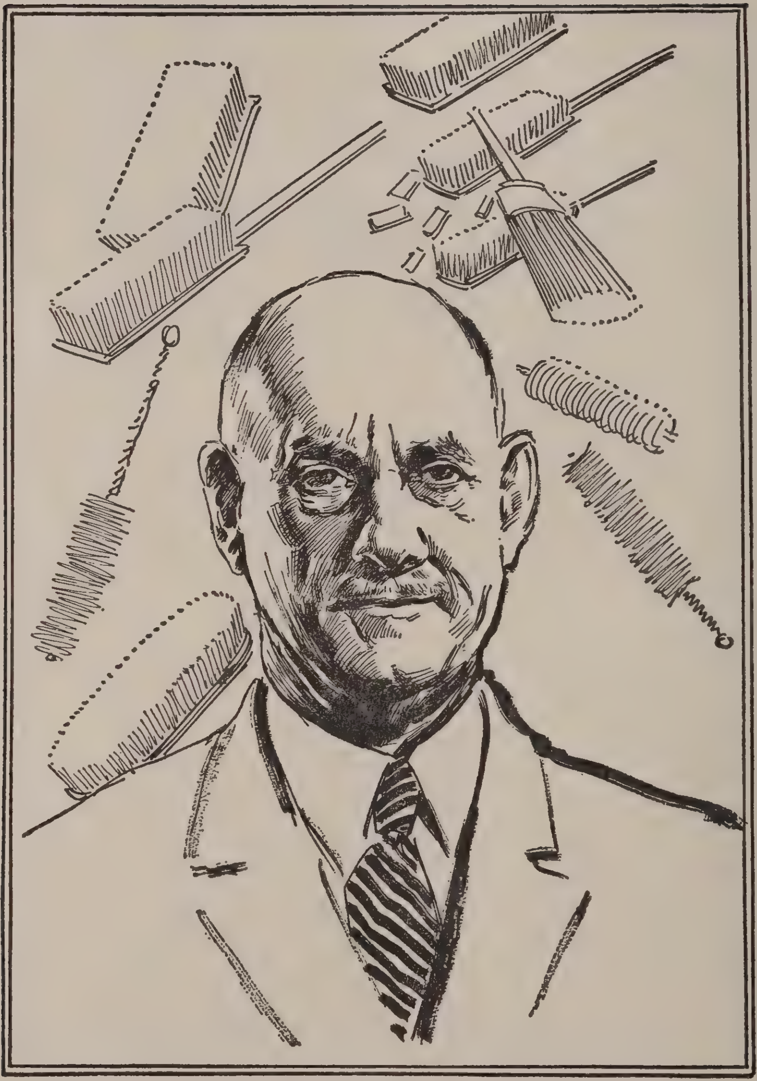
Watson had married Jeannette Kittridge in 1913, and, from the beginning, Mrs. Watson worked with her husband to construct IBM. Eventually she became a director of the firm and her husband frankly admitted, "It would have been impossible for me to build this company to where it is today without Mrs. Watson's cooperation and advice." Four children were born to the Watsons, the two boys joining the IBM organization.

In 1952, Watson turned the presidency of IBM over to his son, Thomas J. Watson, Jr., whom he had been grooming for the job from the age of five. However, "Mr. IBM" still continued to keep in touch with every aspect of the business and refused to retire. "My business has never been work," he told a reporter. "I've always liked playing games. And a business or a profession is the greatest game in the world if you know how to play it."

No one knew how to play the game of business better than this man, who filled the offices of the world with whirring, clicking machines and made it possible for thousands of jobs to be done automatically, but who frequently pointed out that machines were useless and helpless without the most valuable power of all—man power. So he continued to play his favorite game until June 19, 1956, when he died at the age of eighty-two.

Alfred Carl Fuller

1885-



Alfred Carl Fuller

1885-

SINCE coming to Boston to live, nothing had gone right for Alfred Fuller. He had been fired from two jobs and resigned from a third just before being discharged. After passing himself off as twenty-one, although but eighteen, Alfred had been hired as a streetcar conductor at $12.00 a week, but he was dismissed for taking a car out of the barn without permission, losing control and running it off the track. Then, as handy man on the estate of a wealthy widow, he had neglected to currycomb his employer's horse which was shedding, and had been sacked when she returned from a ride covered with horse's hairs. Nor had young Fuller lasted very long as the driver of an express wagon. Years later, he explained, "I quit by mutual consent and relief and then I decided to go into business for myself so I could exert some control over the duration of my employment."

Alfred elected to buy some brushes and peddle them from door-to-door. On his second call, he made his first sale—a radiator brush, but he had no idea as to how it was used, as floor registers supplied heat in his boarding house. Moreover, there was no steam heat in the Fuller farmhouse near Grand Pre, Nova Scotia, the village made famous by Longfellow's *Evangeline*.

The Fullers were a large family. Alfred was the eleventh of twelve children, and the next to youngest of the eight boys. While all were expected to work on the hundred-acre homestead deeded to their ancestors by a Crown Grant in 1761, they always found time to earn pocket money as pickers when the strawberries were ripe. Alfred used some of the cash he received to pay his brother to shine his shoes, for, although Alfred had only gone through the seventh grade, he knew enough mathematics to figure that he could make money by this arrangement. While his brother was busy with rag and polish, he could spend more profitable time in the berry patch.

Fuller made far more money selling brushes than he had picking strawberries—he had $375 in the bank after working for only a year. Convinced that, if he made his own brushes, he could obtain a better product than those in his sample kit and sell them cheaper, Alfred asked permission of one of his married sisters, living near Boston in Somerville, to try manufacturing some in her cellar. She was willing, but one of his brothers warned him that it was a risky venture. However, Alfred paid no attention. Drawing on his experience with machinery on the farm, he designed a brush-twisting machine which was assembled for him in a local shop and bought $50.00 worth of horsehair, bristles, wire and handles.

Soon Fuller was working between seventeen and eighteen hours a day. At night, under a sputtering gas jet, he made brushes by turning the machine's hand crank. Then, after sleeping a few hours, he ate a hasty breakfast, packed his sample kit and began to ring doorbells. Alfred had no trouble selling his brushes and in a short time he was averaging $50.00 a week profit, despite the fact he left a gift at every house. There was just one difficulty—the brushes were so well made that they did not wear out and there was little repeat business.

"They were so good," Fuller once said, "I ran out of customers and had to move."

Finally, he decided to settle in Hartford, Connecticut, where he rented an old carriage shed for $11.00 a month. Here, the brush-making machine was set up and a workman hired to operate it. This meant that Fuller could devote all his time to selling—although he often put on a pair of overalls after calling on customers all day and helped make brushes. After being in Hartford for a year, he balanced his books and discovered sales had totaled $8,500. Alfred Fuller was on his way to become the world's leading manufacturer of brushes and head of an organization that does a hundred-million-dollar business annually.

The first step was to hire five more workmen. With increased production, Fuller was able to call on customers in New York and Pennsylvania, as well as Massachusetts and Connecticut. However, he soon found that this was too much territory for one man. There was no question but that a staff of salesmen was needed. But no one seemed interested in selling brushes until Fuller placed the following advertisement in a national magazine and in an upstate New York newspaper, in 1909:

> Do you know of a good man who would
> appreciate an opportunity to make
> profits of $25 to $30 a week and a
> chance of advancement? Write Box . . .

At first there was no response, and Fuller had almost forgotten the advertisement when a flood of letters from applicants cascaded onto his desk. He was forced to hire a secretary who ran off replies on a secondhand duplicating machine, offering those interested an exculsive territory, twenty-five brushes, sample case and descriptive literature for $6.00. Before long, one hundred men were selling Fuller brushes and, in a year's time, they peddled $30,000 worth. More salesmen were hired and the manufacturing department moved into larger quarters. Sales in 1916 totaled nearly a quarter of a million dollars, and it became necessary to open an even larger factory. One of the reasons for the tremendous increase in business was the establishment of a system of branch offices in large cities throughout the country. By the time Fuller was in his mid-thirties, he had set up a subsidiary in Canada, built a modern factory on Hartford's Main Street and added dozens of varieties of brushes to his line.

During the next twenty years, expansion was rapid. If other brush-makers wanted to sell their plants, Fuller bought them. In 1928, for example, he saw a broom made by a Vermont firm and asked his engineers if they could make a comparable one for the same price. They admitted they couldn't, so Fuller contracted to buy the company's entire output—an arrangement he often negotiated in later years, always reserving the right to supervise the manufacture of any product bought, in order to insure that it would meet his standards, for nothing was ever more important to Fuller than quality. While he cut prices during the 1929 Depression, to meet competition, he refused to use cheaper materials—so it was only by exercising strict economy, cutting costs and retrenching that the firm was able to operate during those trying years. Yet, even though the factory was running on a part-time basis, "Dad," as Alfred Fuller is known to his employees, ordered a revision of production schedules so that only brushes that took considerable time to finish were manufactured. This meant larger paychecks for the workers. No wonder his chief assistant claims, "I've spend the better part of my life keeping the boss from giving the business away."

Far more interested in his employee's welfare than in office detail, Fuller had always preferred to wander about the plant, watch elderly workmen make brushes by hand as he once did (although the factory is filled with automatic brush-making machines) and visit branch offices. One year he traveled cross-country and personally shook hands with four thousand salesmen!

Despite the Depression, "Dad" and his engineers continued to experiment with new products. Out of their investigations came the development of power-wheel brushing and a unique brush handle that can be formed into any shape and not only holds fiber, bristle or synthetics tightly, but prevents them from shedding. When the slump was over, the company was ready to supply industry, as well as housewives, with brushes, of all types. The ladies could also buy the new Fuller line of waxes, polishes, cleaners and disinfectants and, shortly afterward, vitamins and cosmetics. These products were added to the famous sample cases, as salesmen were complaining about the lack of repeat business due to the long-wearing qualities of Fuller brushes—the reason why "Dad" had moved to Hartford.

With the outbreak of World War II, the company was called upon to manufacture forty million brushes for cleaning guns of all types, plastic parts, cartridge tools, torpedo assemblies, radio components and many other items. The skills acquired by his employees in this work were utilized by Fuller at the end of the war when machine shops were set up to make a wide range of products, including aluminum masts for yachts and precision electronic parts.

To the general public, however, Fuller means brushes. There is ample reason for this. Every day in the year, Fuller's 7,000 salesmen call on over 200,000 customers. Whether they travel by dog team in Alaska or by station wagon, all of them use the techniques developed by their employer which have made door-to-door selling a respectable occupation in America.

The men always step back when the door is opened because Alfred Fuller reasoned that a woman alone in a house might be afraid of a stranger. Salesmen give their prospect a present whether she buys anything or not—just as the first Fuller brushman did. From the beginning, "Dad" realized that making a good impression was important, which is why not only are his agents neatly dressed, but they also perform useful services, such as scooping up papers on the lawn or picking up any packages that may be outside the door and handing them to the person who answers. They never attempt to enter a house unless given permission. At first Fuller instructed all his salesmen personally, but today they are schooled by district managers whom he has trained.

Alfred Fuller's theory of salesmanship is simple—"If you push enough doorbells you'll sell enough brushes." However, he has always felt, "The key to selling something is proving that it is everything it is supposed to be, to justify people buying it in the first place. A business has to have character and that character is a matter of the service you can give."

Often Fuller salesmen have to provide unusual services. One agent, asked by a customer if he had ever done any baby-sitting, found himself taking care of an infant for two hours while the mother went shopping! The factory gives excellent service, too—any brush that proves defective is replaced free of charge, just as they were when made in the carriage shed years ago. "Dad" admits he doesn't know any more how many different types of brushes his firm makes, but that is understandable, for not only does Fuller make most of the brushes used in vaccum cleaners, seventy-seven varieties of household types, nineteen industrial mops, dusters, brooms and sponges, but also some seven hundred special designs that are used in thousands of different ways—carding wool, processing leather, rolling cigarettes, polishing fruit and eggs, and removing sand from spinach.

Strangely enough, the twist-in-the-wire brush that Alfred Fuller originated in his sister's cellar is still one of the firm's leading products. Another thing that has not changed is Fuller's habit of keeping in touch with every aspect of the business. He flies across the country in his private plane to visit branch offices, spending a full day checking production lines or talking over research problems with his engineers. Proud of what he has accomplished, he has great hopes for the future. A kindly man, even tempered, dignified and always agreeable, Fuller has been called, "the most loved man in Connecticut."

Above all, Alfred Fuller is convinced that any ambitious young person can achieve success. In a recent interview, he summed up his feelings by saying: "Opportunity is far from finished. It is hardly begun. It is no more difficult and it is no easier to start a business today than fifty years ago. It requires the same amount of personal initiative, the same daring, the same devotion to plain, simple hard work."

Clarence Birdseye

1886-1956

BIRDS
CUT

Clarence Birdseye

1886-1956

In the Middle Ages, according to legend, a hawk swooped down on an English queen, but, before the bird could strike, a page shot it in the eye with an arrow. As a reward, Her Majesty decreed that the boy and all his descendants should be known as "Birdseye" and bestowed upon them the motto, *Stay Right on Target.* No member of the family ever obeyed this royal command as fully as Clarence Birdseye, who solved dozens of technical industrial problems and became world famous for his invention of a continuous freezing system for foods.

As a boy in Brooklyn, New York, Bob (no one ever called him Clarence) was far more interested in nature than in becoming a lawyer like his father. When Birdseye was five, he dressed a mouseskin and gave it to his mother and eventually, he became an excellent taxidermist. He also became a fine cook and, while attending high school in Montclair, New Jersey, volunteered for cooking classes—an experience that was to prove most valuable.

On entering Amherst College, Birdseye attempted to earn the money for his tuition by netting frogs, which he sold to the curator of snakes at the Bronx Zoo, who fed them to his exhibits. He also captured rats for use in experiments at Columbia University. However, these activities did not give him enough money, so he worked as a field naturalist for the United States Biological Survey, which meant that he must leave college in the early spring and return in the late fall. This made it impossible for him to keep up with his classes. Therefore, he left Amherst in 1910 and took a full-time government job. For the next two years, Birdseye did Rocky Mountain spotted fever research in Montana and trapped wolves in northern Michigan. Sent to Labrador on a fish and wildlife survey, he decided to become a fur trapper. From 1912 to 1917, he mushed behind dog teams, assisted Sir Wilfred Grenfell, the medical missionary, on his hospital ship, battled blizzards and freezing cold, and risked his life a hundred times.

During a short vacation spent in the United States, in the summer of 1915, Birdseye married Eleanor Gannett of Washington, D.C., then returned to the North with the understanding that his wife would join him as soon as he could arrange accommodations for her.

Until the arrival of his wife and five-week-old baby in Labrador, in 1916, Birdseye lived on fish and game. Now there was a food problem. Fresh vegetables were rare in Labrador, for they were only brought in by ship. Securing some cabbages from a trader, Birdseye wondered how to keep them fresh as long as possible. Finally, he placed them in a barrel of water, which froze almost immediately in the sub-zero temperature. Now, whenever Mrs. Birdseye wanted a fresh cabbage, her husband would hack one out with an ax. From this simple beginning, a multimillion-dollar business was to develop.

With the entry of the United States into World War I, Birdseye left Labrador and drifted from job to job. He served as assistant purchasing agent of a large engineering firm, purchasing officer of the United States Housing Corporation, sold bottled mineral water and became assistant to the president of the American Fisheries Association. This post gave Birdseye the idea of distributing chilled dressed fish to markets. However, he knew that the success of such a project depended on the development of a practical method of chilling fish. Recalling the barrel of cabbages and a cod that froze in mid-air as he pulled it out of the water one winter in Labrador, Birdseye decided to experiment with quick freezing.

Investing seven dollars in tools, an electric fan, buckets to hold salt water and some ice, he organized the General Seafoods Corporation on a wharf in Gloucester, Massachusetts. Actually, the freezing of fish was a well-known process—whole frozen fish were common in the markets of Europe before World War I. Birdseye's problem was to apply the principles involved to the practical freezing of fish on a commercial scale.

Although Birdseye didn't have much technical education, he did have "a superb restless mind, an insatiable curiosity, enormous persistence, and a total lack of mental blocks." Therefore, he learned all that was known about food freezing and discovered that the previous techniques had produced an unappetizing product because of the presence of large ice crystals that ruptured the food cells. Remembering his experiences in Labrador, he recalled that when the temperature was between 31–25 degrees above, and it snowed, the flakes were large, but they were small when the mercury registered 50 degrees below zero. Perhaps if fish, fruit and vegetables were subjected to extremely low temperatures for a short time, the cellulose in their walls would break down without damage.

While primarily interested in the freezing of the more popular fish, Birdseye experimented with all types of sea food.

Captains of trawlers brought him any unusual catch found in their nets, for they realized that, if Birdseye's scheme was successful, fishing, the oldest industry of Massachusetts, would benefit greatly. As a result, Birdseye froze small whales, sharks, and porpoises—all of which he cooked and found delicious!

Life in the Birdseye house was always fun. Mrs. Birdseye and the four children—two sons and two daughters—never knew what strange dish the inventor of quick frozen food would cook for supper. However, they did know that after the meal was over, he would challenge all of them to a game of Chinese checkers, or show them a Western movie or two, which he called "horse operas."

After many failures, Birdseye developed the belt freezer in 1925. This quickly froze pre-packaged food at a low temperature. The boxes of food were placed between two endless monel metal belts. Then brine was sprayed underneath one belt and on top of the other, providing freezing simultaneously from both top and bottom. In his application for a patent, the inventor explained "the procedure of freezing the product after it has been packed into a tight container" and made it clear "that whether it is a pound of lobster or a quart of strawberries, it presents itself as a square hard brick, highly convenient to handle." The patent was granted. It was one of over 250 that Clarence Birdseye held at the time of his death—but none was more important.

Once the process was perfected, the General Seafoods Corporation began packing and selling thousands of pounds of frozen fish every year. However, Birdseye was not content. He continued to experiment and eventually developed portable quick-freezing units, using refrigerant gases. Always restless, he had no interest in routine managerial duties, although he was an excellent businessman. Once a problem was solved, he promptly turned to something new, such as filleting machines, electrically operated scalers and the possibilities of manufacturing fish sausages. Birdseye hoped to lease any methods he devised or machines he invented to food packers and devote his time to experimentation. His attitude was summed up in the 1925 report of the General Seafoods Company, which explained that the firm operated as "a research laboratory combined with an experimental plant for developing the commercial possibilities of processes and methods evolved in the laboratory." However, food concerns showed little interest in quick-frozen foods and Birdseye's company was forced to distribute its own products.

Not every device Birdseye invented was a commercial success. Although extremely practical, his machine for quick freezing individual vegetables—peas came through a chute, landed on a series of circular rotating plates and froze—was never put into large-scale production. Complete success eventually came in June, 1929, when Birdseye received a check for $22,000,000 for his patents and trademarks. This was the largest sum ever paid up to that time for a single process. The buyers, who eventually formed the General Foods Company, had only 516 outlets for "frosted foods" at the end of three years—today the industry does $2,500,000,000 worth of business annually!

With the sale of his patents, Clarence Birdseye, once so poor that he had to leave college, became an extremely wealthy man. Now he could fulfill two of his desires—to build a pretentious house on the shore of Gloucester Bay and own an expensive automobile. Actually he bought three high-priced cars, but soon went back to driving his old cheap model. Always fond of hunting and fishing, Birdseye built a shooting gallery in the cellar of his house and fitted out a power launch which he christened *Sealoafer.*

Despite his wealth and outdoor activities, Birdseye continued to experiment in his shop. In 1932, he developed and sold a reflector, for use in the display windows of stores, and an infrared lamp. However, food preservation was still his strongest interest and he founded Progress, Incorporated, whose purpose it was to continue research in this field. Birdseye hoped that this organization would discover a method of dehydrating fruits and vegetables that would retain their flavor, normally lost in the process.

After six years of experimentation, the project was successful. In 1945, Birdseye announced his anhydrous method which removed all water content and semi-cooked the finished product, retaining the "flavor, color, texture, aroma and nutritional value of the original." This was made possible by Birdseye's technique of removing water from fruits and vegetables in ninety minutes, instead of the eighteen hours previously required. Soon his new company, Dehydration, Incorporated, was offering a dinner for four in a box the size of a package of cigarettes.

In both quick freezing and dehydration, Birdseye had used the same scientific principle—the rapid exchange of heat. In creating frozen foods, he had removed the heat very quickly; in dehydration, he added heat to dry out the water as rapidly as possible. While little commercial use was made of Birdseye's dehydrated foods, his process proved highly effective in the dehydration of synthetic rubber, brewer's malt and breakfast cereals.

Birdseye's even disposition and good humor never deserted him while experimenting. Nor did his success and the huge fortune he acquired make any difference in the man—his speech was still blunt, his opinions frank and his greatest pleasure derived from simple things.

Whenever Birdseye became weary of working in the laboratory, he relaxed by planting trees on his estate, taking colored movies, cooking unusual foods (by now he was a master chef), playing Chinese checkers or hunting whales with a special harpoon gun he had invented. He did not want to kill the whales, but merely to mark them so that their seasonal migrations could be traced—therefore his harpoon inflicted only slight wounds.

Wide as the range of his hobbies was, Birdseye's technical interests were wider. Although a self-taught scientist, he was sure that paper pulp could be made from agricultural waste products such as crushed sugar cane. His experiments in making paper resulted in a device, patented in 1955, that treated wood chips in such a way that they suffered no physical damage while being pulped. This process also proved of value in the manufacture of asbestos and mica products.

Birdseye's attempts to convert seemingly useless materials into paper carried him to Peru to investigate the possibilities of pulping agave, a native plant. Unfortunately, however, working in the high altitude of the Andes proved too much for his heart. Forced to return to America and avoid exertion of all kind, he moved, with his wife, into a New York City hotel. There, in October, 1956, Clarence Birdseye, sportsman, explorer, scientist, businessman—and creator of an industry—died.

Conrad N. Hilton

1887-

Conrad N. Hilton

1887-

August Hilton had made a fortune operating a stage line, grubstaking prospectors, running a store, trading supplies for furs and exchanging merchandise for produce—wool, hides and beef—at ranches throughout the Territory of New Mexico. However, during the Panic of 1907, Mr. Hilton, like businessmen all over America, found himself in financial difficulties. Therefore, he turned his home in a small town into a five-room hotel and offered traveling salesmen room and board for $1.00 a day. The project was a success from the start—Hilton was a gracious host and his wife an excellent cook. Conrad, second oldest of the seven children, met the trains that stopped at the depot and solicited customers. It wasn't an easy task: one train came in at noon, another at midnight, a third at three in the morning.

Today, president of the Hilton Hotels Corporation, that owns, leases, or operates under management contract hotels throughout the United States and in many foreign countries, Conrad Hilton frankly admits, "I can't honestly say I fell in love with the hotel business as practiced by the Hilton family in 1907." As a matter of fact, he was too tired in those days to approve of anything, for in addition to meeting trains, young Hilton worked from eight o'clock in the morning until six at night in his father's store. This was nothing new—as a youngster he had helped unpack crates, arrange stock on the shelves, and rub down horses in the stage-line corral after attending classes in San Antonio's one-room adobe school. During summer vacations, while enrolled in the New Mexico Military Institute, he had acted as a clerk. When only seventeen, Conrad had packed a wagon full of trade goods, hitched up a pair of mules to it and traveled across the countryside, from ranch to ranch, as his father had been doing for years. With his ability to speak Spanish fluently, the boy had enjoyed bargaining with aristocrats in haciendas and illiterate sheepherders alike. Now, at twenty, weary of meeting trains, bored with swapping canned goods for hides and wool, disappointed that his father's reverses made it impossible for him to go to Dartmouth College, Conrad was not happy.

However, in time the hotel became so well known that it was no longer necessary to meet guests at the station, and business improved at the store. Although Mr. Hilton hired help, he still could not afford to send Conrad to a college in the East, so, despite the fact that his son had no interest in mining, he enrolled him in the New Mexico School of Mines because it was "handy and cheap." During his two years there, Hilton acquired an understanding of, and a great appreciation for, higher mathematics. He also learned to play tennis and developed a lifelong enthusiasm for dancing.

When Conrad came home for his summer vacation after his sophomore year, his father informed him that, instead of clerking in the store, he was going to manage a musical trio, composed of his sister, Eva, who had studied the violin in Boston, and two other girls. The troupe lost money on its tour of mining camps and cowtowns, and its manager was looking forward to returning to school—barnstorming across New Mexico with three girls was harder work than studying, he found! Then, just before it was time to go back to his books, Mr. Hilton, busy with other interests, offered his son complete charge of his San Antonio enterprises, with the understanding that they would share the profits. Conrad promptly accepted, and the next two years taught him lessons in handling people that were to prove invaluable.

When New Mexico joined the Union in January, 1912, Conrad Hilton decided to run for political office, and he became the youngest representative elected to the first state legislature. Ambitious to become an orator, he bought a book on public speaking and went about the house declaiming poems with varying expressions and expansive gestures. This annoyed the rest of the family, and his mother finally convinced him that he would do better to speak naturally. Actually, he had little opportunity to make speeches, and he became so disgusted with politics that he merely marked time until his term was up and then returned to San Antonio and opened a bank.

Hilton's banking activities came to a sudden end when America entered World War I. He enlisted in the Army, was sent to Officers' Training Command, then served overseas as a second lieutenant. While in France, his father died. On returning home, Conrad continued the family business for a while but, feeling restless, disposed of it. Undecided what to do, he took his life savings—$5000—and went to Albuquerque with the idea of starting another bank. He soon discovered that, although his ambition was far greater than the amount of money he needed, his ready cash was far too little for a banking enterprise. Depressed, he talked the situation over with an elderly friend who advised, "Go to Texas, Connie, and you'll make your fortune."

After wandering about Texas for several weeks, Hilton learned that the bank in Cisco, a cowtown in the midst of an oil boom, was for sale. He inspected the books and agreed to buy the institution at the asking price of $75,000, confident he could borrow enough to swing the deal. However, the owner suddenly raised the price and Hilton withdrew. Angry that the banker had broken his word and very disappointed, Conrad, overcome with exhaustion, went to the Mobley Hotel in Cisco to rest.

There was no vacancy. The hotel was not only full, but its rooms were rented three times daily—each guest being allowed to stay for only eight hours. To Hilton's amazement, the proprietor wanted to sell the Mobley and speculate in oil —a typical case of the fever so many Texans were suffering from at this time. Hilton made up his mind quickly—why go looking for a fortune under the ground when you could buy a producing gold mine cheaply? Within a week, he had lined up sufficient backing, dickered and haggled . . . and bought the Mobley for $40,000. It was an excellent investment. Not only did the hotel show tremendous profits, but it taught its new owner a great deal about catering to the public. However, the Mobley rarely provided Hilton with a place to sleep —night after night, four men shared the bed in his room while he cat napped on a chair in the tiny office.

Using loans and their Mobley profits, Hilton and his associates acquired a chain of small hotels in Texas. None of them were beautiful and all needed to have their faces lifted. Nevertheless, once these "dowagers," as Hilton called them, had received a beauty treatment and were given proper management, they did well. Flushed with success, Conrad decided to build a hotel in downtown Dallas. The only trouble was that architects estimated the structure would cost a million dollars, and he didn't have a million. This did not stop him, however. He began the hotel, but soon ran out of money. Always a supersalesman, Hilton convinced the man who had sold him the hotel site that he should finish the construction of the building and then lease the hotel to him. Finally, in August, 1925, the Dallas Hilton opened its doors and was an immediate success, under its leasee's operating slogan—*Minimax*. This meant "minimum charge for maximum service."

Conrad Hilton might well have been content with his achievement, but he was not. With his Dallas venture running smoothly, he outlined a plan under which he would buy a hotel a year. By the time he was forty-one, Hilton was ahead of this ambitious schedule. He had organized the Hilton Hotels Incorporated, and was preparing to expand outside of Texas. Then came the Great Depression. Faced with bankruptcy, he learned how to operate hotels most economically; yet there were times when he could not pay his bills and gladly accepted a five-dollar loan from a bellboy. Somehow, he managed to retain five of his eight hotels during the slump, although he had no income and eventually owed $500,000.

When business improved, Hilton paid off his debts, acquired three more hotels and dusted off his expansion plans. In the summer of 1937, he formed a group of investors and purchased the famous Sir Francis Drake Hotel, in San Francisco. On a hunch, he also bought the twisted shell of a hotel that had been demolished by an earthquake, in Long Beach, California, and, by the time it was ready for operation, the wartime boom made it one of his most successful ventures. Meanwhile, he was purchasing, selling and buying hotels in dozens of cities.

Hilton now was consumed with the desire to own the largest hotel in the world. It took him six years, but eventually he signed the papers that made him the owner of the Stevens, in Chicago. He also bought the famous Palmer House in that city. As a result of his purchase of the Stevens, he learned to maintain the distinctive character of an established hotel and avoid standardization. Noting that only chocolate ice cream was served in the dining room there, he replaced it with fancy ices, only to find that he had violated a Chicago tradition—everyone ate *chocolate ice cream* at the *Stevens!* Realizing his mistake, he removed the ices from the menu.

Ice cream was not the only thing that claimed Conrad Hilton's attention during this period. While he was still learning how to run the Palmer House, he became owner of the swank Town House in Los Angeles, leased a hotel in Mexico and acquired the Plaza in New York City.

As Hilton's flair for hotel purchase and management increased his holdings, he constantly looked at a tattered photograph of the Waldorf-Astoria, America's most famous hotel. Ever since his early days in Texas, he had carried this in his pocket or kept it under the glass on top of his desk. Across the picture Hilton had written, "The greatest of them all," and he dreamed of the day when he would be in a position to go to New York City and buy the Waldorf. Now, as the greatest shareholder in, and president of, the Hilton Hotels Corporation, which was created in 1946 with assets of approximately $51,000,000 (today they are over $235,000,000), he was ready to make his dream come true. In October, 1949, Hilton became known to the hotel trade all over the world as "the man who bought the Waldorf." In the first year of his management, the previously debt-ridden hotel made a million dollars profit!

In all his transactions, Hilton made good use of the trading skills he had learned as a boy in his father's store. As a matter of fact, he saw no difference between convincing a customer to buy a pair of shoes or dealing in millions. "It was," he says, "the same old game in full dress. The buyer was entitled to a bargain if he could get it. The sellers were entitled to their profit." Today, as he directs the ever increasing, large-scale operations of the Hilton organization, he never forgets that each customer desires personal attention and feels that much of his success is due to the fact that his hotels stress hospitality, warmth and charm, whether they may be located in Texas, South America, New York City or on the Nile, in Cairo, Egypt.

Another reason why Hilton has been able to create the world's leading hotel organization out of concrete and vision lies in the fact that he has an unique talent for doing the proper thing. When the Puerto Rico Industrial Company wrote letters to various American hotel operators, asking if they would be interested in furnishing and running a hotel in San Juan, to be built with local capital, only Hilton replied in Spanish. While the Puerto Ricans were greatly impressed with this courtesy, his board of directors did not approve of any expansion outside the continental United States. Hilton finally convinced them of the value of such a move, and Hilton Hotels International was formed. Under its management, hotels are operated in Canada, Egypt, Germany, Greece, Holland, Panama, Puerto Rico, Spain, Trinidad and Turkey. Most of these are financed by local capital and the Hilton organization operates them under a long-term, percentage-rental arrangement—generally two-thirds go to the owners and one-third to Hilton. To insure proper management, citizens of the nation in which a new hotel is to be opened are carefully schooled in Hilton hotels in the United States before taking over their posts.

Always foreseeing profitable opportunities ahead in the hotel business, Hilton continues to expand. In his office there is a map of the world covered with tiny flags. Red flags show the location of present Hilton hotels, blue flags the hotels under construction. Green flags indicate future building sites —and there are a great many of the latter. While some green flags will not be replaced by red ones in the near future, Hilton predicts that, when they are, they will represent buildings greatly different from present-day hotels, for not only will rooms contain radio and television sets, but recording attachments as well, so that guests may receive telephone messages when they are out. Bathrooms, he maintains, will have ultraviolet equipment, sun-tan lamps and towel warmers, while furnishings will include plastic carpets that need no cleaning, and plastic-impregnated furniture so hard it cannot be dented with an ax. One thing is sure—when these items are available, Conrad Hilton will install them in his hotels.

After Hilton bought the Waldorf, his associates were convinced that, in the future, he would be content to expand their holdings slowly. To this surprise, in October, 1954, he engineered the greatest merger in hotel history and the largest real estate deal ever transacted—by buying the Statler Hotel chain. He then pointed out that many motoring tourists avoid large cities as they travel and hence do not patronize mid-town hotels. As a result, the corporation began to build motels along turnpikes and superhighways and created a special division to operate them. Called Hilton Inns, they provide the finest in guest comfort for motorists.

Hilton carefully watches every aspect of his hotels, from the buying of 25,000,000 books of matches and 10,000,000 bars of soap every year to the "digging for gold" in his older hotels. "Digging for gold" merely means that every possible foot of space for the production of maximum income is utilized—something that was not done when hotels were built before the days of scientific planning. While every Hilton employee learns to look for areas of no value to guests or not needed for operational functions than can be put to profitable use, the staff of the Shamrock Hilton in Houston, Texas, brags that it not only digs for gold, but also for oil, for, when this hotel was bought, the deal included some acreage belonging to the former owners which now contains several producing oil wells.

Some thirty thousand employees help Hilton keep his vast operation running smoothly. Most of the key men have risen from the ranks and, in every case, Hilton has shown an uncanny gift of choosing the right man for the job. Once an individual has proved himself, he has the unlimited confidence of his employer and is allowed to make decisions on the local level. Managers and other top personnel are encouraged to invest in the corporation by Hilton, who says, "I try to make everyone around me just a little bit rich."

Riches have also come to the onetime trader who set out for Texas to make his fortune with a grubstake of $5000. However, the lesser part of his wealth is in real estate, stocks and banks. Conrad Hilton has something far more valuable—the admiration and respect of the hotel industry. Success has not changed him, although the poor public speaker elected to the New Mexico legislature has become a polished orator whose talks have won him awards of many kinds. In spite of the fact that he is extremely active in national and world affairs, and a trustee of dozens of foundations, societies and colleges, Hilton still has time to give close attention to each of his hotels and apply modern industrial methods to their operation. No manufacturer pays closer attention to time and method studies, job analysis and standards, safety programs, budget control, weather reports and costs, than he.

Yet every woman guest at the Waldorf who orders breakfast from room service finds a flower on the tray—for Conrad Hilton learned the value of the personal touch in the hotel business when, as a sleepy-eyed youngster, he met the train at three in the morning at the station in San Antonio.

David Sarnoff

1891-

David Sarnoff

1891-

PHONOGRAPH records, radio, talking pictures and television have made the sound of English familiar all over the world. Yet David Sarnoff, who as president of the Radio Corporation of America has probably done more than any other individual to bring this about, could not speak a word of that language when he was nine years old!

David Sarnoff's life is far more fascinating than any of the "rags to riches" stories so beloved by boys a generation ago. Born to poverty-stricken parents in the small Russian village of Uzlian, raised in the squalor of New York's East Side, his brilliant mind, boundless energy and well-directed ambition have made the United States the leading country of the world in electronics and international communications.

Shortly after David arrived in America with his mother and two younger brothers in 1900—his father had emigrated from Russia five years previously—he was forced to go to work because his father fell ill. The youngster managed to help both support his family and remain in school by getting up at four in the morning and delivering newspapers. After classes and during the evenings, he worked in a butcher shop or at other part-time jobs. However, he always found time to study. "I was," he once recalled, "determined from the very first to 'amount to something'; and so I never neglected my books no matter how tired I was."

When Sarnoff was fifteen and had just finished an eight-year school course in six years, his father died. There was no opportunity for any more formal education now, and David went looking for a full-time job. He found one as a messenger boy for a telegraph company which paid $5.00 a week. Although this was hardly enough to support his mother, four brothers and sister—two more children having been born to the Sarnoffs in America—David managed to save enough to buy a telegraph instrument. A friendly operator taught him telegraphy and suggested that he apply for a job with Marconi Wireless. Because young Sarnoff was only sixteen, the firm wouldn't hire him as a telegrapher, but offered to employ him as an office boy.

David took the job, which proved to be the turning point in his life. Years later, he told a reporter, "Somehow I felt then that radio was the newest force in the world, but was destined to be one of the greatest. So I studied, ate, slept and worked at radio."

Therefore, when he was seventeen, Sarnoff gladly became the operator at Marconi's lonely station at Siaconset, Nantucket Island, a post avoided by others. There was little to do there beyond receiving and sending messages to and from the few ships then equipped with wireless apparatus, but he was never idle. The station had an excellent technical library, and Sarnoff read for hours, daily. A year later, he became manager of the Sea Gate, New York, station, the busiest wire center in the country at that time. However, in order to study electrical engineering at Pratt Institute, he applied for a transfer back to New York City at a lower salary. Then, in order to gain experience, he became, for a time, a wireless operator on a seal-fishing vessel in the Arctic.

On the night of April 14, 1912, Sarnoff was manning the most powerful radio station of the day, located on the top of Wanamaker's store in New York City. Suddenly, a distress call came crackling in from the sea: *Ran into iceburg. Sinking fast.*

When the vessel identified herself, Sarnoff was stunned. She was the *Titanic*, the largest ship afloat, making her maiden voyage with a passenger list composed largely of celebrities. What was even more startling was the fact that the *Titanic* had been so constructed that she was considered unsinkable. For the next seventy-two hours Sarnoff sat at his key, picking up faint signals from rescue ships—a task made somewhat easier by President Taft's order that every other wireless station go off the air, so as to avoid interference. Finally, when he had all the details of the dreadful disaster that took more than 1,500 lives, and the names of the 706 survivors, Sarnoff left his post.

As a result of the sinking of the *Titanic*, legislation was passed requiring sea-going vessels carrying fifty or more passengers to have radio transmitting and receiving apparatus. This meant increased business for the Marconi Company and, as its activities multiplied, Sarnoff was given more and more responsibility. Promotion followed promotion until, in 1917, he became commercial manager. When the Radio Corporation of America was formed after World War I and absorbed the Marconi organization, Sarnoff retained his position with the new firm. Here too, he rose rapidly and, at the age of thirty-nine, became president of RCA.

No one in the communications industry was surprised. For Sarnoff's skill in acquiring patents and mobilizing equipment had enabled his employers to develop an outstanding transoceanic wireless service. Moreover, he had played a most important part in the development of radio broadcasting. As early as 1915, he had suggested "a plan of development which would make radio a household utility in the same sense as a piano or a phonograph. The idea is to bring music into the home by wireless."

Because of the war, this proposal was ignored. It wasn't until 1921 that Sarnoff persuaded RCA to risk $2000 in the project and proved it was practical by broadcasting a blow-by-blow description of the Dempsey-Carpentier world championship fight. Convinced, the corporation began to manufacture radio sets, but officials discounted Sarnoff's estimate that within three years sales would total $73,000,000. This forecast was inaccurate—sales amounted to $83,000,000! David Sarnoff had brought radio into the homes of America.

When he predicted that a radio and phonograph in the same cabinet would meet with popular approval, he was given permission to go ahead with the idea. After long negotiations, Sarnoff acquired the Victor Talking Machine Company for RCA and began assembling combination sets. They were an immediate success. Convinced that radio's future depended on a permanent broadcasting service, improved programs, clearer reception and better transmission, Sarnoff conceived the idea of a network of radio stations and organized the National Broadcasting Company.

When sight and sound were synchronized in Hollywood, he directed the development of a subsidiary which supplied talking motion picture equipment to theaters. Meanwhile, at meetings of scientific societies, in interviews and in speeches, Sarnoff prophesied such seemingly fantastic things as short-wave and portable radios, the walkie-talkie, robots and remote-control vehicles. Frequently, RCA engineers disagreed with his "dreams," but Sarnoff stopped their objections and sparked their investigations by saying, "I doubt whether a careful and exhaustive research has been made on this."

No wonder he was chosen president of RCA at thirty-nine!

David Sarnoff couldn't have taken office at a more unfavorable time. Business and industrial firms throughout the country were failing because of the Great Depression. Yet, not only did he guide the company through those trying years, but he showed his confidence in the future by spending millions on research. As early as 1923, he had written, "I believe that television, which is the technical name for *seeing* instead of *hearing* by radio, will come to pass in due course." Now, despite the business slump, he was determined to throw the entire resources of RCA into the development of this new medium of communication.

Most of his associates disagreed with him . . . this was no time to spend money; the idea wasn't practical and, even if it were, the tremendous expense was not justified by the possible results. Sarnoff overruled them. He was as sure of the future of television as he had been of radio.

First he persuaded Dr. Vladimir Zworykin, inventor of an electronic electrical scanner called the iconoscope, to join RCA's research staff and allotted him $100,000 to perfect his device. However, before Sarnoff was able to display a television receiving set at the New York Worlds Fair in 1939 and announce, "We now add radio sight to sound," the project had cost $50,000,000! Then, just as the mass production of television sets was beginning, the United States entered World War II and RCA plants went into government work. Because of Sarnoff's wide-scale peacetime research program, the firm was able to supply the Armed Forces with electronic devices of all kinds.

As soon as possible after gearing the organization to meet the demand for war material, Sarnoff, a colonel in the Reserves since 1924, took a leave of absence and went on active duty with the Signal Corps. Overseas, he served as special communications consultant and was made a Brigadier General in 1944. While in Europe, he conceived a radio program which in time became the *Voice of America.*

After the war, Sarnoff returned to RCA. He immediately ordered research in color television, although many of his aides though the idea impossible. After expending $100,000,000, he proved they were wrong. The "General," as Sarnoff was now affectionately called, had an unique way of inspiring his technicians. For example, at a testimonial dinner given in honor of his forty-fifth anniversary in the radio industry, he asked the research staff for three things and requested that they be perfected within five years. They were: an electronic amplifier of light; a magnetic tape recorder which could record pictures and sound at the same time so that television programs could be either prepared in advance or repeated; and an electronically air-conditioned room, using a system that had no moving parts.

At the dinner celebrating his golden anniversary, Sarnoff received all three as a gift from the research staff. In expressing his thanks, the General said, "I had no doubt that they would solve these problems, and I even thanked them in advance for the presents I confidently expected to receive tonight . . . they are still in what engineers call the development stage . . . but the fact remains that in five short years they have succeeded in turning what were bold dreams and hopes into proud realities."

Sarnoff's dynamic, forceful personality, fertile imagination and genius for inspiring scientists have made him "a man ahead of his time." While his talents have brought him fame and wealth, he is far prouder of the fact that he has used his gifts to benefit his fellowmen.

In 1917, shortly after his promotion to the post of commercial manager of the Marconi Company, Sarnoff married Lizette Hermant of Paris, France. Mrs. Sarnoff quickly learned the secrets of how to get along with an industrial genius, and the marriage, of which three sons have been born, has been most successful. Like her husband, Mrs. Sarnoff leads an extremely active life, but both find time to share in common their love of music and join in community activities.

Today, as a chairman of the board and chief executive officer of RCA, David Sarnoff still has bold dreams. Some day, he claims, atomic waste products sealed and buried under a house will provide the power needs of its inhabitants for a period of twenty years; planes, ships, trains and automobiles will be powered by atomic fuel; solar energy will be harnessed; rockets will carry passengers through the sky at a speed of five thousand miles an hour; weather will be controlled; and users of the telephone will be able to see, as well as to hear, each other.

If these things do come about, much that made them possible will be due to David Sarnoff, the immigrant boy whose inventive genius and industrial leadership have enabled him to master "the art of harnessing the mysteries of science for the betterment of man's destiny."

Walt Disney

1901-

Walt Disney

1901-

PEANUTS, candy, magazines, cold drinks and apples," chanted Walt Disney as he lurched through the swaying railway coaches on the Kansas City to Chicago run.

Although Walt's original ambition had been to become an actor, he was sure that a "news butcher" was the most wonderful job in the world. It meant traveling, meeting people, wearing shiny brass buttons and, best of all, riding occasionally in the locomotive cab. In fact, working on the railroad was just as exciting as the theater, where he had often won the top prize of two dollars on amateur nights with his impressions of Charlie Chaplin, and where he had been a failure in professional vaudeville. Moreover, selling on a train was much easier than getting up at four-thirty every morning to deliver newspapers, as he had done when a nine-year-old. Unfortunately, Walt wasn't a "news butcher" for very long. "It wasn't," he recalls regretfully, "a profitable venture. You see, I was only fifteen—and I ate up all my profits!"

Originally from Chicago, where Walt's father was a contractor, the Disneys moved about a great deal. After the boy lost his railroad job, the family returned to Chicago, and he attended high school for a year. Young Disney was not a good scholar, for he spent more time drawing than studying. His best work in school was done for his seventh-grade teacher, who not only encouraged him to sketch but greatly impressed the boy by her skill with a pistol, when she acted as starter at the track meets. While enrolled in high school, Disney studied cartooning in the evenings. However, both academic and art instruction came to an end in the summer of 1917 when Walt went to work in the post office.

He got the job by a trick. Because he was only sixteen—and looked it—he was refused employment when he applied for a position, despite the shortage of workers due to World War I. Disney went home, put on make-up, changed his clothes, swapped his cap for a hat and returned to the post office. He was immediately hired by the same man who had previously refused to consider him!

That fall, Walt tried to convince American and Canadian recruiting officers that he was old enough to enlist, but was unsuccessful. Finally, he got to Europe as an ambulance driver for the Red Cross. Disney's ambulance was probably the most unusually camouflaged vehicle in history. It was completely covered with pictures, for not even a war could keep Walt Disney from drawing.

After his experiences overseas, Walt considered himself much too grown-up to continue to attend school. He wanted to work, but couldn't decide between becoming a commercial artist or returning to vaudeville. Then, remembering his failure as a professional actor, he settled on art as a career. A Kansas City advertising company specializing in farm-magazine accounts hired him to sketch equipment, bags of mash, cows, chickens and horses. These animals weren't the first Disney had drawn. As a child, he had sketched hundreds with materials furnished by a kindly aunt, and then presented the drawings to a neighbor, a retired doctor.

"I remember one time especially," he once told a reporter.

"I guess I was about seven. The doctor had a very fine stallion which he asked me to sketch. He held the animal while I worked with my homemade easel and materials. The result was pretty terrible—but both the doctor and his wife praised the drawing highly, to my great delight."

No one in the advertising office praised Walt's drawings. The senior staff artists only allowed him to make rough sketches. Then they either finished them, or changed them completely. However, his work must have been satisfactory for, at the end of a week, Disney was told that he had been placed on the payroll at a salary of $50.00 a month. Walt was stunned. A traditionally nonpractical artist, not only had he neglected to ask what his pay would be, but he would have been content with far less.

Walt Disney was the happiest young man in Kansas City—he was getting paid for drawing—the thing he liked to do best of all. Three months later, Walt wasn't so joyful. He was fired. Because of the Christmas rush, he got a part-time job in the post office. While delivering mail, he decided to go into business for himself as a commercial artist. After all, he had been a successful one for three months.

In return for free drawings, the publisher of a small magazine gave Disney desk space in his office. Here, Walt met another young artist, and the two became partners. They designed letterheads and drew theatrical advertisements. At the end of the first month, their sales totaled $125. Business was never as good as that again, however and they began to search through the help-wanted columns in the newspapers. When a slide company advertised for a cartoonist, Walt applied and was hired at a salary of $35.00 a week. "I wasn't," he frankly admits, "worth half of it."

Before long, Disney's partner joined him, and the two made an animated cartoon for their employer. "After we made the advertising film," Walt relates, "my boss let me take home an old camera that was lying around. I rigged up a studio in a garage and started experimenting with animated cartoons in my spare time."

His experiments resulted in a reel of film showing scenes in Kansas City. It was sold to a local theatrical chain that contracted for a similar feature each week. This meant that Walt had to work late at night, but he didn't mind—the mice in the garage kept him company. Whenever Disney was tired, he would stop drawing and watch them scurry about, fascinated by their quick movements. One mouse, far bolder than the rest, would crawl over the drawing board and take food from Walt's hand. The tiny creature showed so much personality that Walt thought he should have a special name. At first he called his pal Mortimer Mouse, but decided Mortimer was much too formal for such a lively fellow and renamed him Mickey Mouse.

Watching Mickey was the only relaxation Walt enjoyed. Between his daytime job and working at night, there was no time to play. Nor could he, laboring alone, carry his animation experiments as far as he wished. Therefore, he arranged for several young artists to join him. They received no salary, but it was understood that, if Disney's scheme to animate fairy tales proved successful, they would be hired as cartoonists.

Six months later, the group had animated *Little Red Riding Hood*, and Walt resigned from the slide company to organize his own firm. It produced seven modernized fairy tales, which were sold to a New York City film distributor. Disney and his staff were jubilant—then came the shattering news that their New York outlet had gone into bankruptcy!

Not even Mickey's antics made Disney smile now. Without funds, deep in debt and jobless, Walt had only one asset —confidence in his ideas. He knew that he couldn't develop them in Kansas City, but was positive he could do it in Hollywood. The problem was to get there.

To raise the fare, Disney made a song film for a theater organist, which paid enough to buy a secondhand motion picture camera. Roaming the streets, Walt took pictures of youngsters and sold them to their parents. When he had accumulated enough money, he bought a ticket and, in August, 1923, arrived in Hollywood with a two-year-old suit, a sweater, some drawing materials and $40.00.

Disney also had a print of one of his fairy tales, but no one was interested in it. If his brother, Roy, who had settled in California some months before, hadn't shared his savings with him, Walt would have starved. The two lived in an inexpensive room and ate in a cafeteria. One would select meat, the other vegetables, and then they would share their orders at the table. At last, a film company suggested that Disney send his fairy tale to their New York office for consideration. He did so. After weeks of anxious waiting, an order came for a series of films similar to the sample.

The Disneys rented the rear of an office, bought a secondhand camera, made work tables out of wooden crates and, with the aid of two girl assistants, produced the first *Alice* cartoon. Walt did all the drawing for six films before he decided that he needed help. Then he sent for his former partner in Kansas City, Ub Iwerks. When other artists were needed, Disney hired the men who had worked on *Little Red Riding Hood.*

Although the films produced by the Disney studio were successful, Walt, always anxious to try something new, decided to go to New York City and suggest a new venture to his distributor. Unfortunately, that individual disagreed with his ideas and, when the conference was over, Walt was discharged. This meant that the cartoons he had created would continue to be produced by artists Disney had trained, but that he would receive no royalty.

Walt had married Lillian Bounds, one of the two girls hired to help make the first *Alice* cartoon, and he and his wife had a serious talk as the train carried them back to California. What could they do? They were sure that some of the staff would be loyal, but of what value were artists and a studio if there was no work? The only solution was for Walt to think of a new central character and interest a distributor in a series of films. However, he could not develop a single idea. He stared out of the window for hours without seeing the passing scenery. Then, suddenly, he jumped to his feet and cried, "I've got it! A *mouse!* Mickey Mouse. Why didn't I think of it before?"

By the time the train pulled into Hollywood, the first *Mickey Mouse* scenario was written. Animated, it was shipped East, but no one wanted the film. There was a good reason for this. Jolson's *The Jazz Singer*, the first motion picture made with sound, had just been released and there was no interest in a silent cartoon. However, a second silent Mickey, unsalable as the first, was made, while a third was planned in sound.

When the last was completed, Disney found it impossible to get the print synchronized in Hollywood, so he took it to New York City, but sound companies either refused the job or demanded excessive fees. The nearly bankrupt artist finally made the necessary arrangements, but the musicians insisted upon using their own system of synchronization, rather than the method Walt had developed. When their way proved unsuccessful, they agreed to try Disney's technique and found it ideal. Wisely, Walt had patented the system a year previously—today it is in widespread use wherever cartoons are made.

Mickey was a tremendous hit with the public, when *Steamboat Willie* was released in 1928. Theatrical managers were equally enthusiastic about the mouse who was to become the most popular motion picture star in the world, but offered no contracts. "All of them," according to Walt, "wanted to buy the Disney company rather than the picture. But I was determined to retain my independence and authority over my product, to safeguard quality and freedom of ideas."

In order to do this, Disney, with his brother Roy's help, set up an organization to release his films independently. This meant that they could produce and distribute their product without control by outsiders. Meanwhile, Walt's bank balance and reputation grew almost as fast as Mickey's popularity. Before long, thanks to the little mouse, the Disney studio became a multimillion-dollar plant, covering fifty-one acres and equipped with the finest of technical devices.

Here Walt developed many new techniques while he constantly experimented in animation. As a result, in 1938, he produced the first feature-length animated cartoon picture, *Snow White and the Seven Dwarfs*. An artistic, mechanical and financial success, it proved Disney's contention: "The animated cartoon is the perfect medium for fantasy."

Pinocchio, *Dumbo*, *Fantasia* and other pictures provided additional proof of this statement by the wizard of the cartoon. Then, on December 8, 1941, the day after Pearl Harbor, Disney made a telephone call to Washington, D.C. From the time that he hung up the receiver until the end of World War II, 94 per cent of the studio's activities were devoted to producing training films for the Armed Services and government agencies. Mickey, Minnie, Pluto, Donald Duck and all the other animal characters created by Walt's genius also worked for victory. Gaily painted on ships, planes, guns and vehicles of all types, they saw action on every battlefield. While the training films received official citations and the insignias were praised as morale builders, the greatest honor came on D-Day—the password of the American troops invading Europe was—Mickey Mouse!

Because the studio had devoted so much of its skill and equipment to the war effort, it was a difficult task to reconvert, but gradually normal production was resumed and Disney went back to experimenting. As a result, he was able to combine live and cartoon action in the same film and once again revolutionized the motion picture industry. One new technique after another was developed and used to make a long list of award-winning films. All of them showed their creator's inventive and versatile genius. While many Disney pictures have been based on fairy tales, fables, legends, folklore, literary and dramatic classics and original stories, factual films are also produced. Among the latter are the *True-Life Adventure* series, dealing with wildlife. The work of well-known, naturalist-cameramen teams, these outstanding natural history features appeal to children and adults alike, when they are shown as motion pictures or on the TV screen, for Walt Disney, the unsuccessful actor who succeeded in bringing entertainment to millions, has the rare ability to amaze and amuse audiences of all ages. No man in the motion picture industry has a greater knowledge of what the public wants, nor has the style and skill to provide it. There is no better example of this than Disneyland—that fabulous sixty-acre park in Anaheim, California, where a visitor "leaves the world of today outside and enters a world of yesterday, tomorrow, fantasy, adventure and frontier days."

Disneyland cost $26,000,000, yet its creator has retained the same unerringly sensitive feeling about his audiences that he had when he arrived in Hollywood with less than fifty dollars in his pocket. An unassuming man, even the office boys call him Walt. Busy as he is, old friends are not neglected and he still finds time to provide Mickey's voice in every cartoon. Restless, creative, constantly seeking new challenges for the camera, he is never satisfied with what he accomplishes.

The Disneys' marriage has been ideal. An artist herself, Mrs. Disney understands and appreciates Walt's work. Moreover, both enjoy movies and watch them three or four times a week in their Holmby Hills home. Disney's two daughters, now married, like all children, used to object to going to bed on "show night," but Walt made it up to them the next day by either swimming, riding or playing badminton with them.

Always experimenting and seeking to improve the techniques of his art, Disney's ideas about mass amusement have not changed—nor has he lost his love of railroading. The onetime "news butcher" now builds and operates scale, steam-powered trains as a hobby. Moreover, despite the fact that he has received over two hundred awards from governments and organizations all over the world, he is no more content with the skills he has mastered than he was with his first cartoons.

It is Walt Disney's sincere belief that there are "wonderful new expansions in the cartoon industry" awaiting development. On the basis of his past achievements, there is no doubt but that this master of showmanship will help bring them about and that his contributions will be unique and imaginative.

Index

Air brake, 59-60
Amherst College, 113-114
Anderson, Colonel James, 53
Armour and Company, 26, 27
Armour, Philip D., 25-32
Armour, Mrs. Philip D. (Malvina Ogden), 27
Assembly line
  perfection of, 69, 74-75
  use in film making, 38
  use in meat packing, 28
Automobile
  development of, 71, 73-75

Bessemer Process, 50
Birdseye, Clarence, 113-119
Birdseye, Mrs. Clarence (Eleanor Gannett), 114, 116, 119
Butler, Nicholas Murray, 96

Carnegie, Andrew, 47-54
Carnegie, Mrs. Andrew (Louise Whitefield), 52
Carnegie Foundation, 53
Carnegie Libraries, 53
Carnegie Steel Company, Ltd., 51-52
Car replacer, 58-59
Chaplin, Charles, 145
Civil War, 20, 26, 31, 50, 58
Columbia University, 96, 113
Columbian Exposition, 63
Computing-Tabulating-Recording Company, 94-95

Dartmouth College, 124
Dehydration, Inc., 118
Dempsey-Carpentier Championship Bout, 138
Depressions
  of 1893, 31
  of 1907, 123
  of 1929, 78, 87, 95, 106, 127, 139
Disneyland, 152-153
Disney, Walt, 145-153
Disney, Mrs. Walt (Lillian Bounds), 150, 153
Dreiser, Theodore, 28

Eastman Dry Plate and Film Company, 39
Eastman, George, 35-43
Edison, Thomas, 72, 87
Employee relations
  bonus system, 51, 75
  housing, 61
  insurance, 42, 61, 96
  pensions, 96
  piece work, 51
  profit sharing, 42
  recreation, provisions for, 88, 96
  stock ownership, 88, 131
  training courses, 61, 96, 117
  vacations, 60-61

Firestone, Harvey, 83-89
Firestone, Mrs. Harvey (Isabelle Smith), 88
Firestone, Harvey, Jr., 88

Firestone Tire and Rubber Company, 85
Food
  dehydration of, 118
  Federal Meat Inspection Act, 30
  freezing of, 115-117
  meat packing, 28-31
Ford, Edsel, 78-79
Ford, Henry, 69-79, 84, 86, 97
Ford, Mrs. Henry (Clara Bryant), 78
Ford, Henry II, 79
Ford Motor Company, 72
Ford, William, 69
Fuller, Alfred Carl, 103-109

General Foods Company, 117
General Seafoods Corporation, 116
Grenfell, Sir Wilfred, 114

Hall of Fame for Great Americans, 57
Hampton Institute, 42
Harding, President Warren G., 87
Harvesting tools
  development of, 15-16
Hilton, August, 123
Hilton, Conrad N., 123-132
Hilton Hotels Corporation, 123, 127
Hilton Hotels International, 129
Homestead Act, 20
Homestead Steel Mill, 51

International Business Machines Corporation, 93, 95
International Chamber of Commerce, 98

Industrial Revolution, 47
Iwerks, Ub, 149

Jazz Singer, The, 150

Kodak, 40

Lee, General Robert E., 26
Lincoln, Abraham, 20
Longfellow, Henry W., 77, 103

Marconi Company, 136, 137
Massachusetts Institute of Technology, 42-43
McCormick, Cyrus, 15-21
McCormick, Mrs. Cyrus (Nancy Flower), 21
McCormick, Robert, 16
Mickey Mouse, 148-150, 151, 152
Model T, 73
Motion Pictures, 138, 148-153

National Art Week, 97
National Broadcasting Company, 138
National Cash Register Company, 94
National Recovery Act, 78
Natural gas, 61
New Mexico Military Institute, 124
New Mexico School of Mines, 124
New York University, 57
New York World's Fair, 139
Niagara Falls
  generation of power from, 63

Overland Trail, 26

Panhandle Railroad, 60
"Patent Virginia Reaper," 19
Pearl Harbor, 151

Pennsylvania Railroad, 48, 50
Photography
  "American film," 40
  cameras, 37, 40-41
  daylight loading film, 41
  dry plate, 38-39
  rolled film, 41
  wet plate, 37
Plastics, 27
Pratt Institute, 136
Progress, Incorporated, 118
Puerto Rico Industrial Company, 129
Pullman, George, 48, 49
Pynchon, William, 29

Radio
  development of, 136-137
  network system, 138
Radio Corporation of America, 135, 137
Refrigerator cars, 30
Roosevelt, President Franklin D., 98
Rubber, 77, 86, 118
Rubber Association of America, 87

Sarnoff, David, 135-141
Sarnoff, Mrs. David (Lisette Hermant), 141
Scott, Thomas A., 48
Selden Patent, 73-74
Seligman, Dr. Edwin, 41
Shakespeare, 51
Stanley, William, 62
Stanton, Edwin M., 20
Steam turbine, 64
"Stopper lamp," 63
Strong, Henry, 38-39

Taft, President William Howard, 137
Television, 139, 140
Temple of Peace, 53
Tesla, Nikola, 62, 63
Titanic, 137
Tires
  development of, 84, 85, 89
Tuskegee Institute, 42

Union College, 58, 64
United States Biological Survey, 114
United States Housing Corporation, 115
United States Steel Corporation, 52
University of Rochester, 42

Victor Talking Machine Company, 138
Voice of America, 140

Walker, William, 39-40
Watson, Thomas J., Jr., 99
Watson, Thomas J., Sr., 93-100
Watson, Mrs. Thomas J., Sr. (Jeannette Kittridge), 99
Westinghouse Electric Company, 61
Westinghouse, George, 57-65
Westinghouse, Mrs. George (Marguerite Walker), 59
Woodruff, T. T., 48
World War I, 75-76, 87, 114, 125, 146
World War II, 78, 96, 107, 139, 151-152

Zworykin, Dr. Vladimir, 139

SIGMUND A. LAVINE

just missed being cradled in a theatrical trunk. His parents were permanent members of John Craig's famous stock company, and his arrival made it unnecessary for the stage manager to provide a doll whenever the play called for a baby!

Highly active while in college, he wrote features for the Boston *Sunday Post*, covered Boston University sports for two wire services, occasionally sold two-line jokes to *College Humor*, played leads in Shakespeare productions and stage-managed five annual presentations of the Gilbert and Sullivan Association. "This last experience," Sigmund Lavine maintains, "was the beginning of a search for anything by or about Gilbert and Sullivan—with the result that the bookcases in my Milton, Massachusetts, home contain books behind books dealing with the Kings of Topsy-turvydom."

After receiving his M.A., he taught in a United States Government Indian School at Belcourt, North Dakota, for two years, learned to speak both the Sioux and Cree languages and talk in sign language, had long conversations with old-timers who could remember the creak of the axles of covered wagons, and was invited to tribal dances, ceremonies and Indian Court in reservations throughout Canada and the Northwest.

Sigmund Lavine has taught in the Boston Schools for over twenty years and is now an assistant principal. He also lectures and writes literary criticism.

With his wife, their two children (Maxine and Jerrold), Carrie, their whippet, and Andrea ben Ghazi, their prize-winning Afghan hound, he lives in a house filled with books, fish tanks and historical china. His family enjoys cruises to South America, cross-country motor trips and truck gardening on a piece of New Hampshire land which, the author says, "contains all the rocks the glacier had and didn't know what to do with—however, we always have a pumpkin for a jack-o'-lantern."

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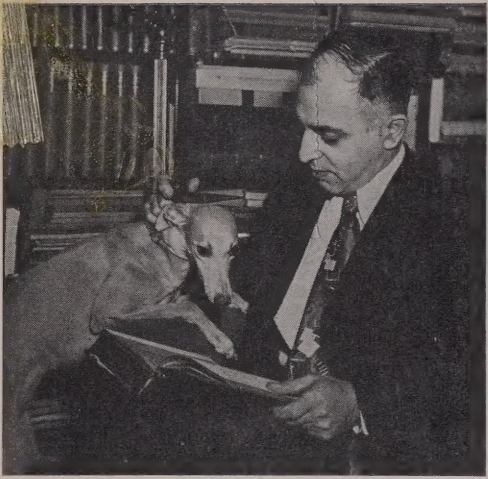

PHOTO BY MACDONALD

SIGMUND A. LAVINE

was highly active while in college; he wrote features for the Boston *Sunday Post* and covered Boston University sports for two wire services. His parents were permanent members of John Craig's famous stock company, so, quite naturally, he played leads in Shakespeare productions and stage-managed five annual presentations of the Gilbert and Sullivan Association.

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